ENERGY ANALYSIS

FOR

Fort McNair
Marshall Hall

US Army Corps
of Engineers

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

PERFORMED BY

ENTECH

ENTECH ENGINEERING INC.
READING, PENNSYLVANIA

AUGUST 1995

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

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FORT McNAIR, MARSHALL HALL
ENERGY ANALYSIS

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1.0 EXECUTIVE SUMMARY

Marshall Hall was selected by the US Army Corps of Engineers to participate in the Energy Efficiency Analysis Program. The objective of this program is to assist military installations in identifying energy usage and cost saving projects at their facilities and possibly provide funding for projects. Entech Engineering, Inc. was selected to perform this study.

Ft. McNair spent $444,600 on energy for Marshall Hall, $1.83 per square foot, during fiscal year 1993. Of this amount, electricity comprised 78% of the cost while the remaining 22% was from natural gas. Entech has identified the following areas as having the greatest cost savings potential:

Lighting
Boiler Operation
Cooling System Operation
Energy Management System Operation
Kitchen Equipment

A total of twenty-seven (27) Energy Conservation Opportunities (ECOs) were developed and evaluated. ECOs describe the means to reduce energy consumption and operating cost. Of the twenty-seven (27) ECOs, fourteen (14) have been developed as economically feasible. The remaining thirteen (13) investigated did not prove to be economically attractive.

The economic feasibility of a recommended ECO is measured by the simple payback period and savings to investment ration (SIR). Entech and the EEAP

Program recommend that ECOs with a simple payback period of under ten (10) years and SIR greater than one (1.0) should be further considered for implementation. ECOs with payback periods of under four (4) years should be considered for more immediate implementation.

The estimated total cost for the construction of the recommended ECOs is approximately $607,700. The estimated annual energy savings are about $180,400 for a 41% reduction from current energy expenditures. This savings yields an average simple payback period of 3.4 years. In addition, approximately $1,100 in maintenance savings would be realized. A summary of the recommended ECOs is shown in Table 1.0.1. The recommended ECOs are prioritized by SIR. Table 1.0.2 lists non-recommended ECOs.

ECIP Projects: To qualify for an ECIP project, an ECO or group of ECOs must have a construction cost greater than $300,000. In addition, a simple payback period of less than 10 years and an SIR greater than 1.0 must be achieved. Presently there is no single recommended ECO or groups of recommended ECOs which would qualify for ECIP funding. This finding was determined during the Pre-Final meeting on July 26, 1995. It should also be noted that ECO #9 is currently in the ECIP program.

Non-ECIP Projects: These are ECOs which do not meet the construction cost and payback period criteria, but have an SIR greater than one (1.0). All ECOs recommended ECOs into this category. In addition, there are some non-recommended which had SIRs greater than 1.0. Non-ECIP Projects are listed in Table 1.0.4.

Table 1.0.1, Recommended ECOs, Prioritized by SIR

ECO #	*ECO Description*	*Construction Cost*	*Energy & Maint. Savings*	*Payback Period (yrs)*	*SIR*
1	Reduce Boiler Cycling	$9,000	$13,300	0.7	38.1
2	Expand Energy Monitoring and Control System	$50,000	$58,000	0.9	24.9
3	Shut off Boiler in Summer	$14,000	$11,400	1.2	20.1
4	Security Room AC Renovations	$7,000	$2,600	2.7	6.8
6	Reduce Building HVAC Outdoor Air Requirements	$16,000	$4,400	3.6	5.1
4A	Shutdown Chiller During Winter and Summer Unoccupied Periods	$77,000	$19,800	3.9	4.7
11	3' HPS Bollards	$800	$200	4.0	4.6
7	Replace Electric Dishwasher Booster Heater	$20,000	$5,000	4.0	4.0
8	100 Watt HPS Loading Dock Luminaires	$6,500	$1,200	5.4	3.4
5	Electric Cooking Equipment to Natural Gas	$25,000	$6,400	3.9	3.2
9	4' T-8 Lamp Retrofit	$210,000	$34,700	6.1	3.0
13	Motion Sensors	$15,000	$2,400	6.3	2.9
10	Reflectors	$137,900	$19,600	7.0	2.6
14	Exit Signs to LED	$13,000	$1,800	7.2	2.5
12	Replace 75 Watt Mercury Vapor Wall Washers	$6,500	$700	9.3	1.9
	Totals	$607,700	$181,500	3.3	

Table 1.0.2, Non-Recommended ECOs, Prioritized by SIR

ECO #	*ECO Description*	*Construction Cost*	*Energy & Maint. Savings*	*Payback Period (yrs)*	*SIR*
E	Shutdown Chiller During Winter and Summer Unoccupied Periods	$90,000	$23,500	3.8	4.8
C	3' MH Bollards	$800	$190	4.2	4.1
F	Security Room	$12,000	$1,400	8.6	2.2
L	Electric Rate "GT-3B"	$500,000	$55,400	9.0	1.9
H	Peak Shaving with Diesel Generators	$145,000	$11,700	12.4	1.5
J	Oxygen Trim Controls on Boilers	$22,000	$1,100	20.0	1.3
G	Variable Frequency Drive Controllers	$110,000	$8,900	12.4	1.3
A	150 HPS Loading Dock Luminaires	$6,500	$400	16.3	1.1
B	2' and 3' T-8 Lamp Retrofit	$19,000	$1,100	17.3	1.1
K	PEPCO's Curtailment Program	$145,000	$8,400	17.3	1.0
I	Chilled Water Storage	$290,000	$10,300	28.2	0.6
D	Exterior Lighting	$16,000	$400	40.0	0.5

Table 1.0.3, Recommended ECIP Projects, Prioritized by SIR

ECO #	*ECO Description*	*Construction Cost*	*Energy & Maint. Savings*	*Payback Period (yrs)*	*SIR*
1	No ECOs Qualify as ECIP Projects				
	Totals				

Table 1.0.4, Non-ECIP Projects, Prioritized by SIR

ECO #	*ECO Description*	*Construction Cost*	*Energy & Maint. Savings*	*Payback Period (yrs)*	*SIR*
1	Reduce Boiler Cycling	$9,000	$13,300	0.7	38.1
2	Expand Energy Monitoring and Control System	$50,000	$58,000	0.9	24.9
3	Shut off Boiler in Summer	$14,000	$11,400	1.2	20.1
4	Security Room AC Renovations	$7,000	$2,600	2.7	6.8
6	Reduce Building HVAC Outdoor Air Requirements	$16,000	$4,400	3.6	5.1
7	Shutdown Chiller During Winter and Summer Unoccupied Periods	$77,000	$19,800	3.9	4.7
12	3' HPS Bollards	$800	$200	4.0	4.6
8	Replace Electric Dishwasher Booster Heater	$20,000	$5,000	4.0	4.0
9	100 Watt HPS Loading Dock Luminaires	$6,500	$1,200	5.4	3.4
5	Electric Cooking Equipment to Natural Gas	$25,000	$6,400	3.9	3.2
10	4' T-8 Retrofit	$210,000	$34,700	6.1	3.0
14	Motion Sensors	$15,000	$2,400	6.3	2.9
11	Reflectors	$137,900	$19,600	7.0	2.6
14	Exit Signs to LED	$13,000	$1,800	7.2	2.5
13	Replace 75 Watt Mercury Vapor Wall Washers	$6,500	$700	9.3	1.9
	Totals	$607,700	$181,500	3.3	

Table 1.0.5 on the following page shows the comparison of existing energy use, and energy use after all recommended ECOs are implemented.

The following sections of this report describe in detail the findings as outlined above and contain the necessary cost estimate and calculation backup data as required. The reader is encouraged to carefully review each of the following report sections to understand the assumptions, methodology, and discussions involved.

Table 1.0.5, Energy Use Before and After ECOs

Description	*Existing*	*Proposed*	*Savings*	*Percent*
Total Energy Cost	$444,600	$264,210	$180,390	40.6%
Total $ per sf	$1.83	$1.08	$0.75	41.1%
Total Energy (mmBtu)	30,399	17,000	13,399	44.1%
Total Energy (Btu/sf)	124,867	69,828	55,038	44.1%
Electric Usage (kWh)	5,080,693	2,696,959	2,383,734	46.9%
Electric Demand (kW)	12,388	9,041	3,347	27.0%
Electric Cost $	$345,300	$205,010	$140,290	40.6%
Electric Energy (mmBtu)	17,340	9,205	8,136	46.9%
Electric Energy (Btu/sf)	71,228	37,809	33,419	46.9%
Natural Gas Usage (mcf)	12,678	7,568	5,110	40.3%
Natural Gas Cost $	$99,300	$59,200	$40,100	40.4%
Natural Gas Energy (mmBtu)	13,058	7,795	5,263	40.3%
Natural Gas Energy (Btu/sf)	53,639	32,019	21,620	40.3%
Fuel Oil (gal)	0	0	0	0.0%
Fuel Oil Cost $	0	$0	$0	0.0%
Fuel Oil Energy (mmBtu)	0	0	0	0.0%
Fuel Oil Energy (Btu/sf)	0	0	0	0.0%
Building Area	243,450	243,450	243,450	

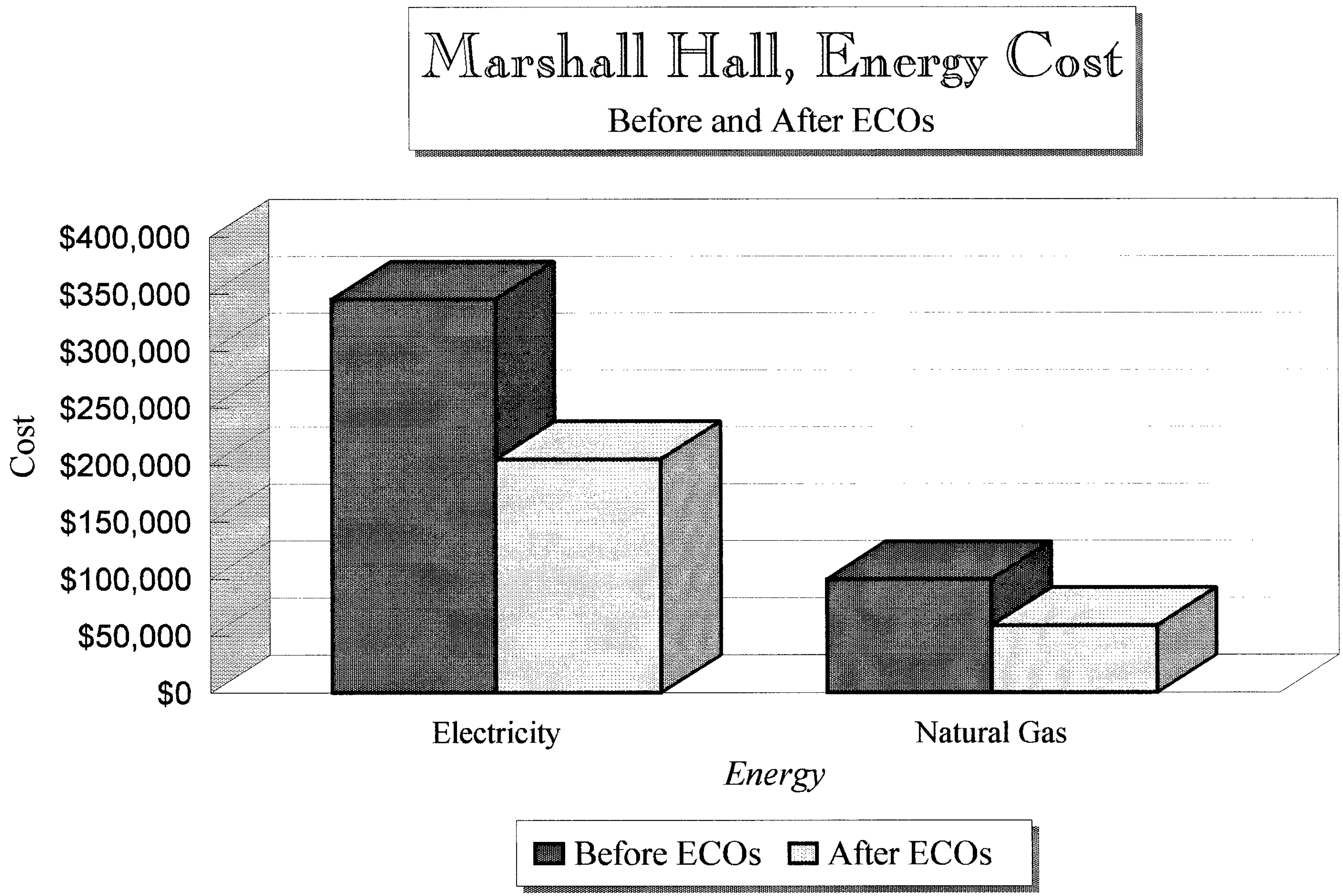

Marshall Hall, Energy Cost
Before and After ECOs
Cost
$400,000
$350,000
$300,000
$250,000
$200,000
$150,000
$100,000
$50,000
$0
Electricity
Natural Gas
Energy
Before ECOs
After ECOs

Figure 1.0.6

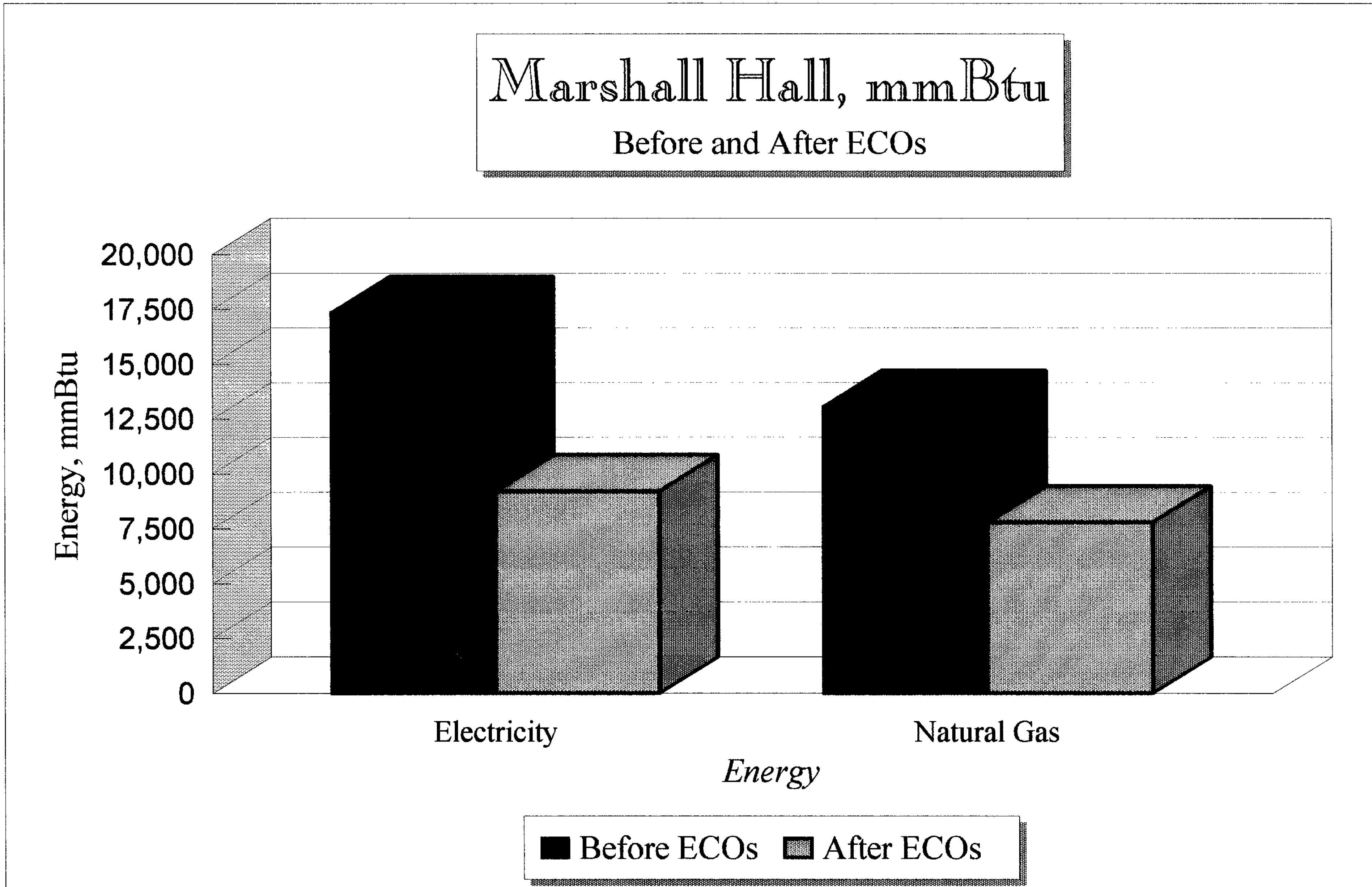
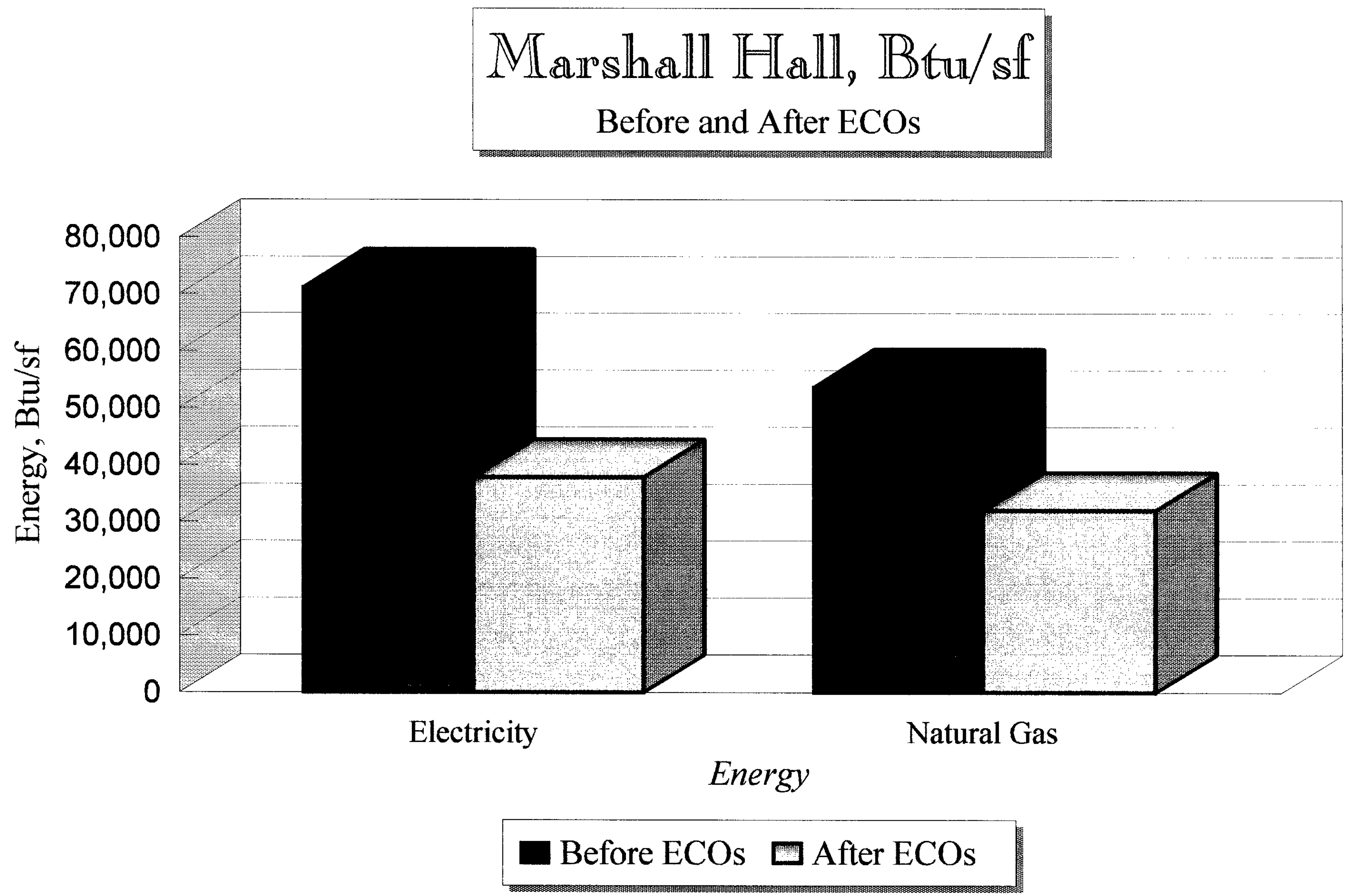

Marshall Hall, mmBtu
Before and After ECOs
20,000
17,500
15,000
12,500
10,000
7,500
5,000
2,500
0
Energy, mmBtu
Electricity
Natural Gas
Energy
Before ECOs
After ECOs

Figure 1.0.7



Marshall Hall, Btu/sf
Before and After ECOs
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Energy, Btu/sf
Electricity
Natural Gas
Energy
Before ECOs
After ECOs

Figure 1.0.8

2.0 METHODOLOGY

2.1 General

The intention of this energy report is to assess Marshall Hall's current energy consumption and provide recommendations to improve energy efficiency. Entech has developed a very thorough format which is adhered to during the development of an energy report. This format has permitted Entech to construct comprehensive reports in a smooth and timely process. Entech has employed the format in the preparation of over five-hundred (500) energy studies for commercial, industrial, and institutional clients.

The following is a listing of the components in Entech's methodology for completing energy studies:

1. Kickoff Meeting
2. Data Collection/Initial Review
3. Site Inspection
4. Model Existing Energy Characteristics
5. Energy Conservation Opportunities
6. Draft Report generation
7. Client Review
8. Final Report Generation

2.2 Kickoff Meeting

In order to initiate the process, Entech scheduled a kickoff meeting at Marshall Hall in October of 1994. Entech was represented by William M. McMahon Jr. and Jack Fisher. John Forgue, Baltimore District Corp. of Engineers, represented the government. Other government agency representatives were also in attendance.

The purpose of the meeting was to introduce both parties and explain the process Entech was planning to follow during the study. In addition, the government's expectations were noted and incorporated into the project.

2.3 Data Collection/Initial Review

Prior to the first site inspection, Entech requested electric and gas billing data for Marshall Hall. Entech reviewed the data to determine the operating profiles of the building. In addition, Entech visited both the Capital Area Office POC, Ft. Belvoir, and the C.O.E. Office, Baltimore, to review construction and design documents.

2.4 Site Inspection

Entech performed site inspections of Marshall Hall during the months of November and December 1994. During these visits, Entech investigated lighting and HVAC systems.

Lighting: Entech visited each area of the building and recorded the quantity, type, and wattage of lighting luminaires. In addition, the operation and effectiveness of the systems were recorded.

HVAC: During the lighting survey, Entech investigated the heating, air conditioning and ventilation systems of the building.

In addition to the above areas the following were also collected.

1. Operating Schedules
2. Building Photographs

3. Building Drawings

Entech interviewed building personnel to acquire an accurate overview of building function and operation. An inventory of Energy Conservation Opportunities (ECOs) was developed and compiled after the conclusion of each site inspection.

2.5 Model Existing Energy Consumption

2.5.1 General

Once the site investigation phase is complete, Entech models the existing operation of energy users within the building. Entech uses in-house computer programs, purchased computer programs, and literature to assist in calculating current energy costs for equipment, HVAC, and lighting systems. The three main computer models used to estimate energy use is as follows:

1. Lighting Model
2. Electric Model
3. Heat Loss/Gain Model

2.5.2 Lighting Models

Entech uses a Lotus spreadsheet program to model the lighting load of distinct areas of the building. A sample lighting model is shown in Table 2.5.2.1.

Information collected during the site inspections is entered into the program to develop a monthly estimate of energy cost, usage, and demand which is associated with building lighting. The program breaks

Sample Lighting Model
Table 2.5.2.1

Room or Area Description	Luminaire Type (1)		Light Levels (FC)	No. Of Lum.	Lamps Per Luminaire	Watts Per Lamp	Total Watts	Off-Peak Time Period: hrs Per Week	Off-Peak Time Period: Off-Peak Kwh Per Month	Intermediate Time Period: hrs Per Week	Intermediate Time Period: Inter. Kwh Per Month	On-Peak Time Period: hrs Per Week	On-Peak Time Period: On-Peak Kwh Per Month	Percent Of Kw On-Peak	Demand Kw On-Peak	Total Kwh Per Month	Electric Costs: Monthly Demand (Kw)	Electric Costs: Monthly Usage (Kwh)	Electric Costs: Monthly Cost $
AHU-1N & AHU-1S																			
Ground Floor:																			
Lobby & Vestibules	A16	1.15		20	1	40	920	5	20	20	80	30	120	95.0%	0.9	219	$5.77	$10.74	$16.51
Lobby & Vestibules	F4	1.15		22	1	75	1,898	5	41	20	164	30	247	95.0%	1.8	452	$11.90	$22.16	$34.06
Lobby & Vestibules	D15	1.15		11	1	18	228	5	5	20	20	30	30	95.0%	0.2	54	$1.43	$2.66	$4.09
	TOTALS			53			3,045		66		264		396		2.9	726	$19	$36	$55

Winter Incremental Demand Cost $/Kw =	$6.60
Off-Peak Incremental Usage Cost $/Kwh =	$0.037
Intermediate Incremental Usage Cost $/Kwh =	$0.046
On-Peak Incremental Usage Cost $/Kwh =	$0.053

NOTE #1: FOR BALLASTED LUMINAIRE A BALLAST FACTOR OF 1.15 IS USED, INCANDESCENT LUMINAIRE USE 1.

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down the costs by room or area. A definition of each column heading in the model is as follows:

Area: Location of lighting luminaires.

Type: Distinguishes luminaires with ballasts from luminaires without ballasts. The number 1.15 is the ballast factor included for luminaires which incorporate ballasts. These include Fluorescent, High Pressure Sodium, Metal Halide, and Mercury Vapor. A 15% increase in electrical load created by the ballast is accounted for by using this factor. A ballast factor of one (1) is used for incandescent luminaires since there are no ballast losses.

Illum (FC): Footcandle light level reading measured in each area.

# of Luminaires: Number of luminaires in each area. Luminaires used only for emergency lighting are not included.

Lamps/Luminaires: Number of lamps per luminaires.

Watts per Lamp: The rated electric loss per lamp or bulb. (Ballast losses not included.)

Total Watts: Total watts is calculated by multiplying (Type) x (# of Luminaires) x (Lamps per Luminaire) x (Watts per Lamp).

Hrs/Wk: The estimated hours of operation in one week.

% of kW on Peak: The estimated amount of connected load that is contributing to the typical monthly on-peak electrical demand. Normally this is less than 100% to account for burned out lamps.

kW on Peak: Calculated by multiplying (Total Watts) x (% On-Peak) ÷ (1,000 Watts/kW).

Monthly kWh: Calculated by multiplying (Total Watts) x (Hrs/Wk) x (4.3 Wks/Mo) ÷ (1,000 Watts/kW).

Monthly Costs: Calculated by multiplying kW and kWh by the incremental rates for demand and usage shown at the bottom of the lighting model.

2.5.3 Recommended Light Levels

Table 2.5.3.1 is extracted from the Illuminating Engineering Society (IES) and shows recommended light levels in footcandles for various areas and activities within the building. These values were compared with the levels recorded during the site investigations and were used to identify problem areas.

TABLE 2.5.3.1
IES LIGHT LEVEL RECOMMENDATIONS

Area/Activity	Recommended Light Level
Classrooms	50 - 100 fc
Locker Rooms	10 - 20 fc
Machine Shop	50 - 100 fc
Print Shop	50 - 100 fc
Auditorium (Assembly)	20 - 50 fc
Conference Room	20 - 50 fc
Drafting Room	50 - 100 fc
Kitchens	50 - 100 fc
Dining Areas	10 - 20 fc
Offices	50 - 100 fc
Library Reading Area	50 - 100 fc
Library Stack Area	20 - 50 fc
Computer Room	20 - 50 fc
Recreation Rooms	10 - 50 fc
Storage Rooms	10 - 20 fc
Bathrooms	10 - 20 fc
Stairways and Corridors	10 - 20 fc
Lobbies	10 - 20 fc
Building Entrances	5 fc
Gymnasium	30 fc

2.5.4 Electric Model

Entech's electric model is a computer spreadsheet used to identify electric loads within the building and to identify the individual contribution to electrical demand, usage, and cost.

Loads have been identified from site investigations and drawings. Information from the lighting model is reflected in the electric model.

It is important to realize that the electric model is an approximation of the electricity used by each load. It shows general relationships and gives a reasonable allocation of electrical demand, usage, and cost.

Demand (kW) contributions and estimated kWh usages are then included in subsequent calculations of the Energy Conservation Opportunities of Section 6.0.

A sample electric model is shown in Table 2.5.4.1. A description of each column heading follows:

Connected Load: The total connected electric load is expressed in kW.

Winter Demand: The average kW contributing to the billing demand each month. Winter months include December, January, February, and March.

Sample Electric Model
Table 2.5.4.1

No.	Description	Total Connected Load (kW)	Winter Demand kW/Month	Inter Demand kW/Month	Summer Demand kW/Month	Winter Billing Months						Intermediate Billing Months						Summer Billing Months						Non-Summer					Summer					No.
						Off-Peak		Inter.		On-Peak		Off-Peak		Inter.		On-Peak		Off-Peak		Inter.		On-Peak												
						hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	Demand kW/Yr.	Off-Peak KWH/Yr.	Inter KWH/Yr.	On-Peak KWH/Yr.	Cost $	Demand kW/Yr	Off-Peak KWH/Yr.	Inter KWH/Yr.	On-Peak KWH/Yr	Cost $	
1																																		1
2																																		2
3	*AIR HANDLER #1*	2.2	1.9	1.9	1.9	10.0	660	6.0	264	6.0	264	10.0	660	6.0	264	6.0	264	10.0	660	6.0	264	6.0	264	13	4,620	1,848	1,848	$454	9	3,300	1,320	1,320	$416	3
4																																		4
5																																		5
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34																																		34
	TOTALS	0	0	0	0		0		0		0		0		0		0		0		0		0	0	0	0	0	$0	0	0	0	0	$0	

Historical Billing Demand Averages

Dec	0	Apr	0	Jun	0
Jan	0	May	0	Jul	0
Feb	0	Nov	0	Aug	0
Mar	0			Sep	0
				Oct	0
Avg	0		0		0

0	Dec	0	Dec	0
0	Jan	0	Jan	0
0	Feb	0	Feb	0
0	Mar	0	Mar	0
0		0		0

0	Apr	0	Apr	0
0	May	0	May	0
0	Nov	0	Nov	0
0		0		0

0	Jun	0	Jun	0
0	Jul	0	Jul	0
0	Aug	0	Aug	0
0	Sep	0	Sep	0
0	Oct	0	Oct	0
0		0		0

Winter Months, December, January, February, March
Intermediate Months: April, May, November
Summer Months: June, July, August, September, October

	Winter	Summer
Incremental Demand Cost, $/kW	$6.60	$17.09
Off-Peak Incremental Usage Cost, $/kWh	$0.037	$0.034
Intermediate Incremental Usage Cost, $/kWh	$0.046	$0.047
On-Peak Incremental Usage Cost, $/kWh	$0.053	$0.062

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Intermediate Demand: The average contribution to billing demand in the intermediate months of April, May, and November.

Summer Demand: The average contribution to billing demand in the summer months of June, July, August, September, and October.

Winter Usage: The estimated full load equivalent off-peak, intermediate, and on-peak hours that the load operates in a day within the following schedules during the months of December through March. The following table lists the utility billing periods.

Billing Period	Time of Day	days/mo
Off-Peak	12:00 am to 8:00 am 24hrs Saturday/Sunday	30
Intermediate	8:00 am to 12:00 pm 8:00 pm to 12:00 am	20
On-Peak	12:00 pm to 8:00 pm	20

The kWh/mo in the next column is then calculated by multiplying (Connect Load) x (Hrs/Day) x (# of days). The lighting load is calculated in the lighting model and included within the electrical model.

Intermediate Usage: Same as winter usage except months are April, May, and November.

Summer Usage: Same as winter usage except months are June through October.

Non-Summer and Summer Totals Per Year: The kW/month for each season is multiplied by the appropriate number of mo/season to calculate annual kW for non-summer and summer. The kWh/year is calculated in the same manner as kW. The non-summer and summer costs are calculated by multiplying kW and kWh by the incremental costs.

2.5.5 Heat Loss Model (Degree Day Method)

A building heat loss model, based upon the ASHRAE Degree Day Method, was developed for Marshall Hall. This computer model is one of the tools utilized by Entech to determine heating usage and costs. The model estimates the design heat loss in Btu/hr and also approximates energy usage and costs associated with space heating.

A sample heat loss model is shown in Table 2.5.5.1 on the following page. This model is not particular to any building or area, rather it is only to be used for methodology explanation. The building is divided into various heating zones that possess distinct characteristics. Wherever possible, the space or zone reflects the actual zoning of the heating system. The various areas are combined to give a total building model of space heating.

The model is divided into three sections as follows:

Exterior Data: The heat loss attributed to transmission losses through walls, windows, doors, and roofs. A U-value is calculated for each building element and is shown at the bottom of the page.

HEAT LOSS CALCULATION
SAMPLE, TABLE 2.5.5.1

		EXTERIOR DATA							VENTILATION, INFILTRATION IN					TERIOR D	BELOW GRADE		
SPACE NAME		WALL HEIGHT FT	WALL LENGTH FT	WINDOW AREA SQ FT	DOOR AREA SQ FT	WALL AREA SQ FT	WALL U FAC	ROOF AREA SQ FT	CEILING HEIGHT FT	FLOOR AREA SQ FT	SPACE VOLUME CU FT	INF AIR CHANGE CFM	VENT AIR CFM	WALL HT FT	WALL LENGTH FT	FLOOR AREA SQ FT	TOTAL HEAT LOSS BTU/HR
WALLS ON GROUND		15.0	106	360	0	1,230	0.26	0	12.5	1,584	19,800	198	1,050	0	0	0	
FLOOR	BTU/HR			23,760	0	19,188		0				12,830	68,040		0	0	123,818
	COST-$			$152	$0	$123		$0				$82	$436		$0	$0	$793
		0.0	0	0	0	0	0.00	0	0.0	0	0	0	0	0	0	0	
	BTU/HR			0	0	0		0				0	0		0	0	0
	COST-$			$0	$0	$0		$0				$0	$0		$0	$0	$0
		0.0	0	0	0	0	0.00	0	0.0	0	0	0	0	0	0	0	
	BTU/HR			0	0	0		0				0	0		0	0	0
	COST-$			$0	$0	$0		$0				$0	$0		$0	$0	$0
		0.0	0	0	0	0	0.00	0	0.0	0	0	0	0	0	0	0	
	BTU/HR			0	0	0		0				0	0		0	0	0
	COST-$			$0	$0	$0		$0				$0	$0		$0	$0	$0
		0.0	0	0	0	0	0.00	0	0.0	0	0	0	0	0	0	0	
	BTU/HR			0	0	0		0				0	0		0	0	0
	COST-$			$0	$0	$0		$0				$0	$0		$0	$0	$0
		0.0	0	0	0	0	0.00	0	0.0	0	0	0	0	0	0	0	
	BTU/HR			0	0	0		0				0	0		0	0	0
	COST-$			$0	$0	$0		$0				$0	$0		$0	$0	$0
		0.0	0	0	0	0	0.00	0	0.0	0	0	0	0	0	0	0	
	BTU/HR			0	0	0		0				0	0		0	0	0
	COST-$			$0	$0	$0		$0				$0	$0		$0	$0	$0
		0.0	0	0	0	0	0.00	0	0.0	0	0	0	0	0	0	0	
	BTU/HR			0	0	0		0				0	0		0	0	0
	COST-$			$0	$0	$0		$0				$0	$0		$0	$0	$0
		0.0	0	0	0	0	0.00	0	0.0	0	0	0	0	0	0	0	
	BTU/HR			0	0	0		0				0	0		0	0	0
	COST-$			$0	$0	$0		$0				$0	$0		$0	$0	$0
TOTALS			106	360	0	1,230		0		1,600	19,800	198	1,050		0	0	
	BTU/HR			23,760	0	19,188		0				12,830	68,040		0	0	123,818
	COST-$			$152	$0	$123		$0				$82	$436		$0	$0	$793

OUTSIDE TEMPERATURE (°F	5
INSIDE TEMPERATURE (°F)	65
DELT TEMPERATURE (°F)	60
HEATING DEGREE DAYS/YR.	5,108
FUEL COST, $/UNIT	$4.06
HT VALUE, MMBTU/UNIT	1.03
SYSTEM EFFICIENCY (.XX)	78.0%
$/MMBTU (WITH EFF.)	$5.05

DOOR U FACTOR (BTU/SQFT*F*H)	0.4
WINDOW U FACTOR (BTU/SQFT*F*H)	1.1
ROOF U FACTOR (BTU/SQFT*F*H)	0.09
GRND FLOOR FACTOR (BTU/SQFT*H)	0.56
GRND WALL FACTOR (BTU/SQFT*H)	0.38
ANNUAL COST FACTOR ($/YR/BTU/HR)	0.006402
C (D)	0.62

WIND VELOCITY (MPH)	15
INFILTRATION AIR CHANGES/HR	0.6
INFILTRATION AIR CHANGE FACTOR	0.01
WINTER GRND WATER TEMP (°F)	50
GROUND TEMP DELTA TEMP (°F)	15
GROUND WALL FACTOR	0.3
BELOW GRADE DELT TEMP (AD USTED)	4.5
GROUND FLOOR FACTOR	1.995

HEAT LOSS, MMBTU/	201
HEAT LOSS,BTU/DEG	39,368
UNITS FUEL/DEG DA	0.04
UNITS FUEL/YR	195
COST, $/SF/YR	$0.50
COST, $/CF/YR	$0.0400
BTU/HR/S	77

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Ventilation/Infiltration: The heat loss attributed to the ventilation system. Wherever possible, building design data was used to calculate the amount of outside air (cfm) being brought in for ventilation., Infiltration was based on air change estimates based on the following building construction:

Tight	0.3	Air change/hr
Average	0.6	Air change/hr
Leaky	1.0	Air change/hr

The value used is shown at the bottom of Table 2.5.5.1.

Below Grade: The heat loss through the floor and any underground walls. The average ground temperature is assumed to be 50°F.

Each zone has three lines of information. The first line is the input data used such as wall areas, window area, etc. The second line is the calculated design heat loss (in Btu/hr) based upon the input data. This number represents the amount of heat loss during the design condition of 0°F outside temperature.

For example, in Table 2.5.5.1, the window area in zone 1 is 340 sf. The associated heat loss through the window is therefore, 23,760 Btu/hr and is calculated as follows..

$$Heat\ Loss = 360\ sf \times 1.1\ \frac{Btu}{sf{\cdot}^{\circ}F{\cdot}hr} \times (65^{\circ}F - 5^{\circ}F)$$

The third line is the estimated energy cost for the year based on the heating degree day formula. This procedure is based on Chapter 28 of the 1985 Fundamentals Handbook of ASHRAE. In our example, using the zone 1 windows, the annual energy cost associated with transmission losses through the windows is $152 per year.

$$Cost = \frac{\left(HeatLoss \times hdd \times 24\frac{hr}{day}\right)}{\left((outtemp - intemp) \times 1{,}000{,}000\ \frac{Btu}{mmBtu}\right)} \times \frac{\$}{mmBtu} \times C_D$$

$$Cost = \frac{\left(23{,}760\ \frac{Btu}{hr} \times 5{,}108 hdd \times 24\frac{hr}{day}\right)}{\left((65\,°F - 5\,°F) \times 1{,}000{,}000 \frac{Btu}{mmBtu}\right)} \times \frac{\$5.05}{mmBtu} \times 0.62$$

C_D is an empirical correction factor for heating effect versus 65°F degree days found in the ASHRAE Fundamental Handbook.

2.5.6 EZDOE

General: Entech utilizes an hourly energy use simulation program known as EZDOE. This program is a PC version of the Department of Energy's simulation program known as DOE-2.1D. The program has the capability of calculating hour-by-hour energy use of all aspects of a building. This program will be used to substantiate estimates prepared by other modeling tools throughout this study. This section will provide a short overview of the program and its capabilities.

Energy Calculations: EZDOE calculates the annual energy consumption of HVAC systems based on U.S. Department of Energy standards. The program contains four (4) main simulation sections utilized are as follows:

1	Loads
2	Systems
3	Plants
4	Economics

Loads: This portion of the program allows the user to construct a database on the building. Some of the areas of input are listed below:

1	Exterior and Interior Wall Constructions
2	Roof Constructions
3	Window Details, Exterior Door Details
4	Schedules, Daily, Weekly, and Monthly
5	Luminaire Type and Load
6	People Occupancy Rates
7	Space/Area Definition
8	Miscellaneous Loads Such as DHW Usage
9	General Equipment Load
10	City/Weather References

Systems: This section simulates air distribution systems which can be utilized within a building. Twenty-two different air handling systems are supported. In general, spaces defined under loads can be attached to systems. The following table lists some features which can be assessed:

1	Variable Air Volume
2	Preheating
3	Night Setback
4	Economizer
5	Reheating, Humidification
6	Baseboard Heating
7	System Scheduling

Plants: This section simulates the building's physical plants (boilers, chillers, water heaters, etc.) and various options. The program has the capability of sizing equipment based on loads or sizes that can be manually enter into the program. A wide variety of equipment can be simulated. The following table lists additional features which can be utilized.

1	Thermal Storage
2	Peak Shaving
3	Demand Limiting
4	Load Management

Economics: This portion provides a means to simulate utility tariffs and costs. Fuel consumption during specific time periods can also be generated. The following is a list of features which can be utilized:

1	Demand Costs
2	On-Off Peak Usage Costs
3	Demand Ratchets
4	Seasonal Rates

2.5.7 mmBtu/Unit

The following energy values have been used in the energy calculations in this report. These values are from the Institutional Conservation Program (ICP) as administered by DOE. The following table lists conversion factors from Appendix A of Architect/Engineer Services Instruction. Both listings are generally within 10% of each other. The units used throughout this report, electricity, gas, and oil are within 1% of each other. This variance is within acceptable levels.

Table 2.5.7.1 mmBtu/Unit

Fuel Type	ICP, DOE Btu/Unit Used	A&E Manual	Notes
Natural Gas (mcf)	1,030,000	1,031,000	minor
#1 Heating Oil (gal)	134,204	-----	n/a
#2 Heating Oil (gal)	138,690	138,700	minor
#4 Heating Oil (gal)	144,503	-----	n/a
#6 Heating Oil (gal)	149,690	149,700	minor
Propane (gal)	91,500	95,500	n/a
Coal (ton)	24,000,000	24,600,000(Bit)	n/a
Steam (lbs)	1,150	1,000	minor
Electricity (kWh)	3,413	3,413	same

2.6 Energy Conservation Opportunities (ECOs)

After the energy models have been finalized, Entech proceeds to analyze the ECOs which were developed during the site inspection. An ECO describes an idea for decreasing energy usage or costs, and the format consists of the following sections:

1	Existing Condition Description
2	Proposed Condition Description
3	Capital Cost Estimates
4	Energy Savings
5	Discussion

2.6.1 Existing Condition

A general description of the existing condition will be provided as well as current annual energy usage and cost.

2.6.2 Proposed Condition Description

The project, which is to be implemented, will be described in adequate detail. The expected energy usage and cost for the proposed project will be formulated and shown.

2.6.3 Capital Cost Estimates

The capital cost estimates prepared for this study are considered to be "conceptual" in nature. They are conceptual because they are based upon engineering design that is less than one percent of a complete detailed design effort for such a project.

The cost estimates are broken down into material, labor, and engineering components. Calculations or a spreadsheet are usually provided with each ECO.

The final results of a project can vary significantly from the "Conceptual" cost estimate. The American Association of Cost Engineers (AACE) generally states that an accuracy range of plus or minus 20% from the total estimated cost is possible. Variations beyond this range are possible for the stated scope, but not likely.

Since it is not possible for the consultants to know the most likely variations that can occur in the future, nor can they control certain technologies, contractors, or general economic conditions. The costs estimated herein should not be construed as fixed or precise. Rather, they are estimates which will require a great deal of effort to manage until the final costs are realized.

2.6.4 Cost Savings

This division of the ECO compares the existing and proposed energy costs and notes increases or decreases in energy consumption.

2.6.5 Discussion

Entech notes the expected simple payback period for the ECO. Any additional benefits or concerns are noted in this section.

2.7 Draft Report/Client Review/Final Report

After the previous sections have been substantially completed, Entech proceeds to compile the information into the report format. Entech schedules a meeting with the client to present its findings. A copy of the report is supplied to the client for a more detailed review. The client's review process typically lasts 2-3 weeks.

Entech will then proceed to incorporate the clients review comments and produce a final report.

3.0 FACILITY DESCRIPTION

3.1 General

Marshall Hall, The National Defense University Academic Operations Building, is located on the grounds of Fort Lesley J. McNair, Washington, D.C.. Building construction was completed in 1991 and encompasses approximately 243,450 gross square feet of floor area on three floor levels. Marshall Hall is utilized for numerous activities and maintains the following areas.

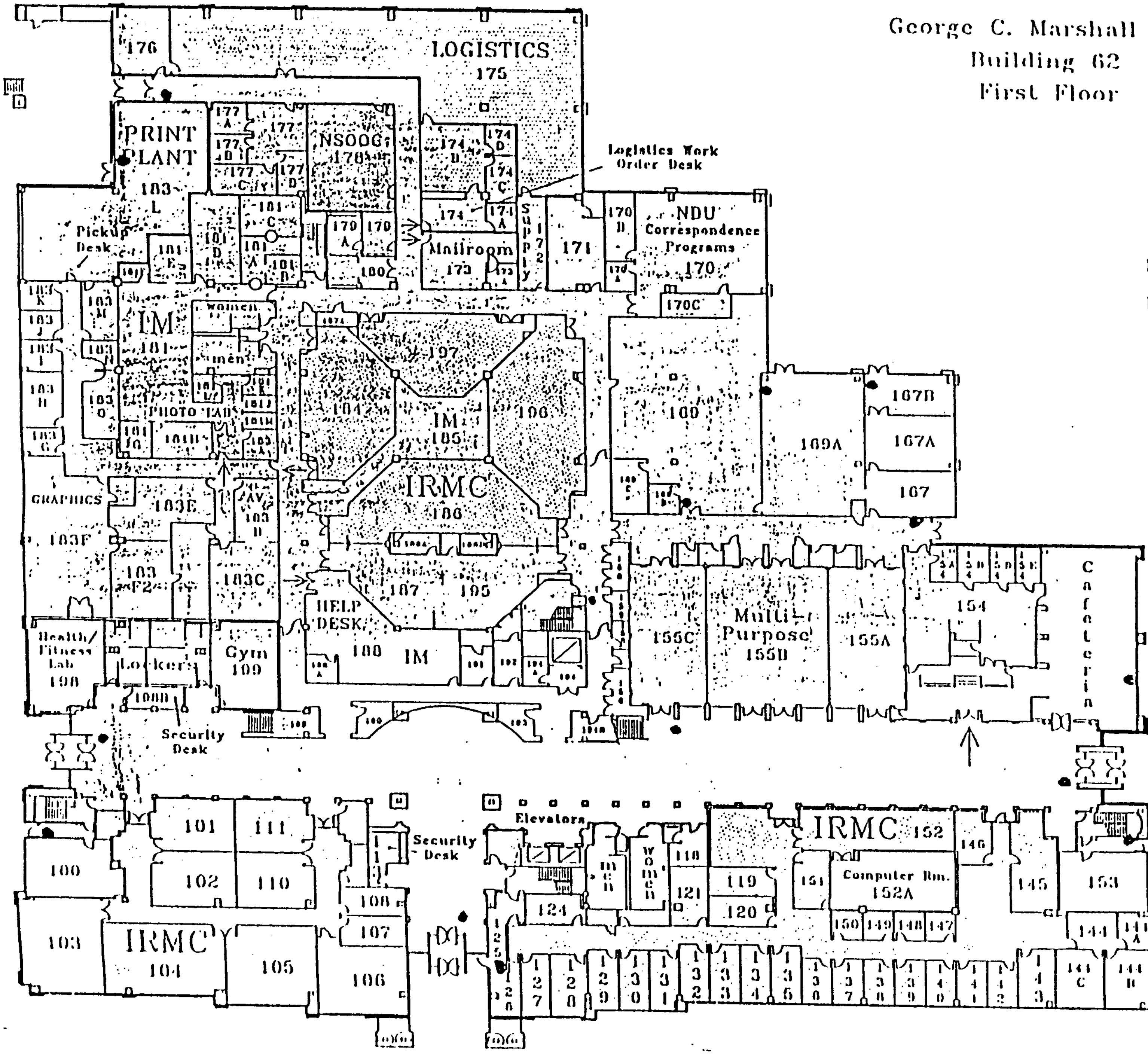
Table 3.1.1, Building Use

1	Classroom Facilities
2	Conference Rooms
3	Meeting Rooms
4	Computer Labs
5	Dining Facilities
6	Library
7	Printing Shop

3.2 Building Occupancy

General: Marshall Hall's daily occupancy averages approximately 450 people. Currently a full-time staff of less than 400 people is maintained. Building occupancy can vary significantly by as much as an additional 400 - 600 people. The increase generally occurs during times of special conferences, two or three times a month. Marshall Hall has no set hours of operation. Staff and kitchen personnel begin to arrive around 6:30 a.m. The building is fully occupied between 9:00 a.m. and 4:00 p.m. Most of the staff leaves the premises prior to 5:00 p.m. Security personnel tend to occupy the facility 24 hours per day.

George C. Marshall Hall
Building 62
First Floor

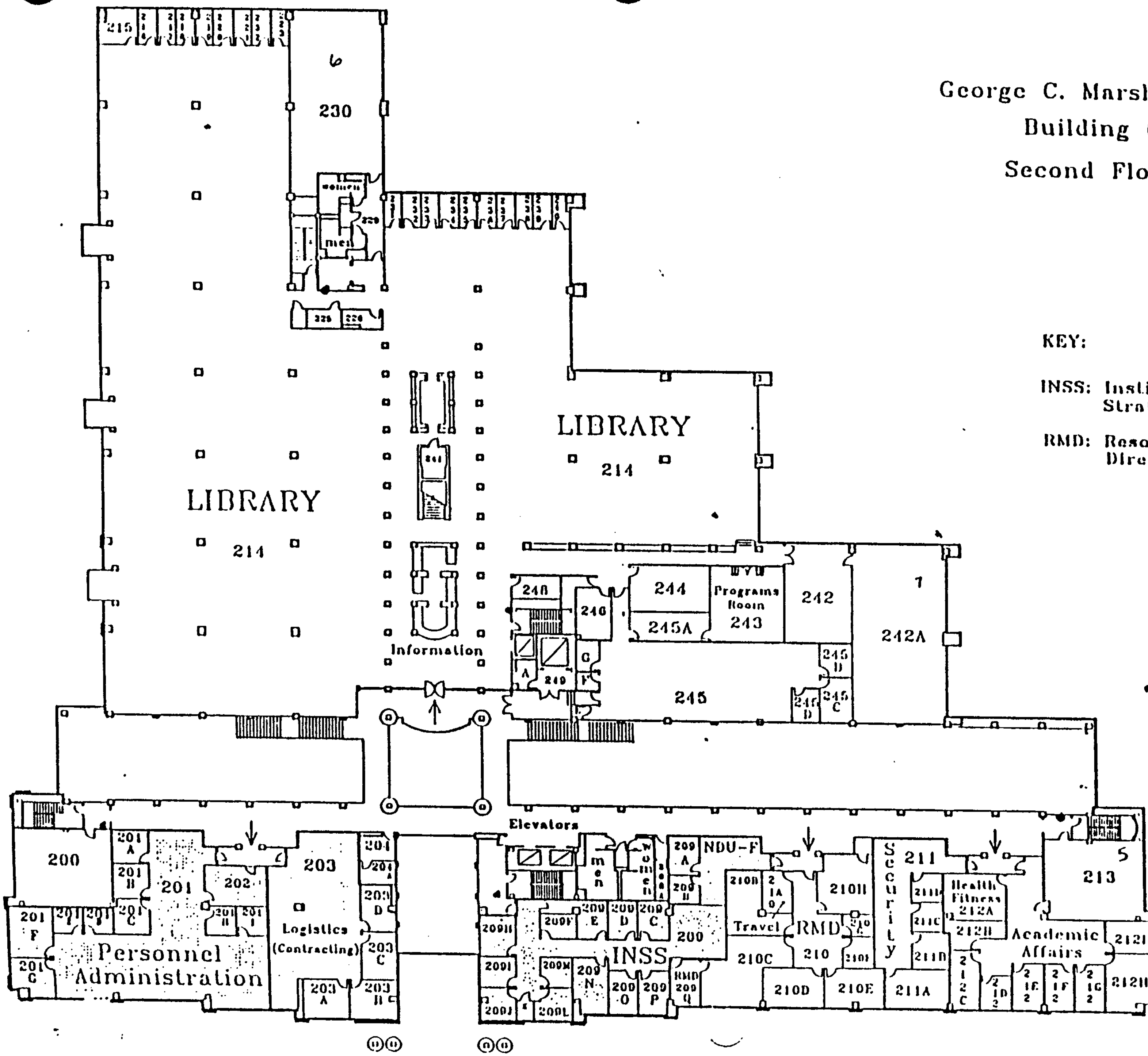


KEY:

IRMC: Information Resources Management College

IM: Information Management

NSOOC: NATO Staff Officer Orientation Course



George C. Marshall Hall
Building 62
Second Floor

KEY:

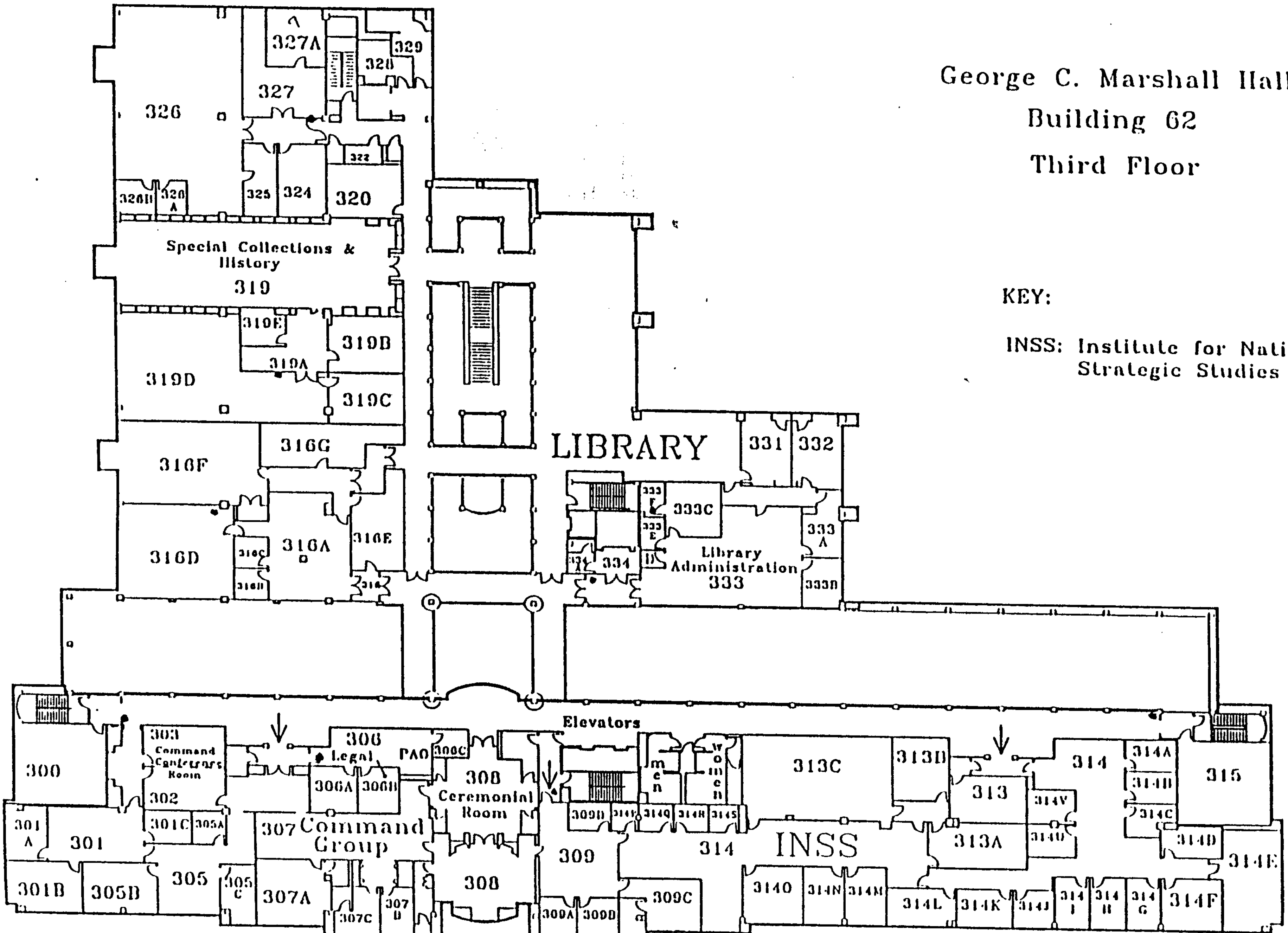
INSS: Institute for National Strategic Studies

RMD: Resource Management Directorate

George C. Marshall Hall
Building 62
Third Floor

KEY:

INSS: Institute for National Strategic Studies



Library: The library is available for use five days a week between the hours of 8:00 a.m. and 5:00 p.m. By special request, the library may be opened for use on weekends.

Dining Facilities: The cafeteria is generally open for breakfast and luncheon meals. According to kitchen personnel, approximately 300 meals are prepared daily. This quantity varies with the level of building activity. The cafeteria is in operation between the hours of 5:30 a.m. and 2:30 p.m.

3.3 Building Structure

Exterior Walls: In general, the typical exterior wall construction consists of a 4" masonry unit, 6" of insulation, and building board. The masonry unit varies between brick and stone. Total exterior wall resistance is calculated at 21.4 as show below.

Table 3.3.1, Wall Resistance

Material/Thickness	*Resistance Value*
Outdoor Air Film	0.17
4" Masonry Unit	0.44
Building Felt	0.06
½" Gypsum Sheathing Board	0.45
6" Insulation	19.00
5/8" Gypsum Board	0.56
Indoor Air Film	0.68
Total Resistance	21.40
Thermal Transmission (1/R)	0.05

Roof: In general, the typical roof construction consists of a membrane roofing material over rigid insulation board on concrete decking. The total roof resistance is calculated to be 23.0.

Table 3.3.2, Roof Resistance

Material/Thickness	*Resistance Value*
Outdoor Air Film	0.17
Membrane Roofing	0.00
3.5" Rigid Roofing	22.00
4" Preformed Concrete Slab	0.24
Indoor Air Film	0.61
Total Resistance	23.00
Thermal Transmission (1/R)	0.04

Glass: Window area utilizes tinted insulating glass. The thermal transmission U value is 0.53 and the shading coefficient is 0.34.

3.4 Mechanical Systems

Heating: Marshall Hall's heating plant consists of two (2) natural gas fired steam boilers operating at 15 psi. Boilers are rated at 100 HP and 50 HP. Boiler operation is in response to maintain system steam pressure. Boilers are located in an equipment room on the first floor level. The following table lists information on the boilers gather during site investigation and from drawings.

Table 3.4.1, Boiler Schedule

#	*Fuel*	*HP*	*Steam lbs/hr*	*Blower HP*
B-1	Nat Gas	100	3450	3
B-2	Nat Gas	50	1725	2

A boiler feed system is used to collect condensate and pump make-up water back to the boilers. The system consists of a 3/4 HP, 150 gallon feedwater pump set and a 1/3 HP, 10 gallon condensate receiver.

Steam is utilized for outdoor air preheat, space humidification and hot water heating system. Six (6) of the ten (10) building air handling units have steam preheat coils and nine (9) have humidifiers installed. Humidifier and preheat coil operation is controlled by the building energy monitoring and control system. Table 3.4.2 lists preheat and humidification capacities by air handlers.

Table 3.4.2, AHU Preheat and Humidification Coil Size

Air Handler #	*Preheat, MBH*	*Humid., lbs/hr*
1N		
1S		45
2	1,580	157
3	725	74
4	786	131
5		92
6	1,625	184
7	274	31
8		61
9	44	10

Hot water for the heating system is generated by a steam-to-water convertor. Water temperature is controlled by a single steam control valve in response to heating water supply temperatures. The supply water temperature is reset in response to outdoor air temperature. The current heating system is designed for 180°F leaving the convertor and 160°F entering the convertor.

Two (2) heating system hot water pumps circulate water throughout the building. Pumps are rated to circulate 180 gpm each and have 7.5 HP motors installed. The pumps are capable of both stand alone and parallel pumping operation. The hot water heating system services include:

1. Preheat outdoor air for four (4) building air handling units.
2. Reheat coils for numerous variable air volume systems.
3. Perimeter finned tube radiation.
4. Space cabinet and unit heaters.
5. Five (5) building fan coil units and two (2) computer room units.

The table below lists hot water coil sizes for the air handler units.

Table 3.4.3, AHU Hot Water Coil Sizes

Air Handler #	*Coil, MBH*
1N	202
1S	517
5	389
8	449

Building heating system components are controlled by a combination of two and three position type control valves in response to space temperature.

Cooling: Marshall Hall is primarily cooled by two (2) electric water cooled centrifugal chillers. The chillers are rated at nominal 400 tons and 250 tons each and are operated in response to maintain chilled water supply temperature. The chillers are located in an equipment room on the first floor level. The following table list information on the chillers:

Table 3.4.4, Chiller Schedule

#	*Type*	*Tons*	*Volts*	*Amps*
CH-1	Centrifugal	400	460	360
CH-2	Centrifugal	250	460	230

Chiller heat is rejected to a centrifugal counterflow type cooling tower. The cooling tower has two (2) cells and has a nominal capacity of 680 tons. Each of the cooling tower fans is driven by a 50 HP motor. The cooling tower is located on grade adjacent to the chiller equipment room.

Two (2) condenser water pumps circulate cooling water between the chillers and the cooling tower. Two (2) chilled water pumps circulate chilled water between the chillers and the building air conditioning air handling units. Pumps are located within the chiller equipment room. The following table lists information on the pumps:

Table 3.4.5, Cooling Pump Schedule

#	*Service*	*gpm*	*HP*
3	Chilled Water	400	15
4	Chilled Water	640	30
5	Condenser	750	20
6	Condenser	1,200	30

The condenser water system is designed for 85°F water leaving the cooling tower and 95°F water entering the cooling tower, and outdoor ambient design wet bulb temperature is 78°F. The two condenser water pump capacities are matched with their respective chiller, 400 tons/1,200 gpm and 250 tons/750 gpm.

Chilled water system is designed for 45°F water leaving the chillers and 60°F water entering the chillers. The chilled water pump capacities are also matched with their respective chiller, 400 tons/640 gpm and 250 tons/400 gpm.

A single 7 ton packaged air cooled chiller is installed to provide dedicated cooling for the special collections area by AHU-9 . This is a glycol chilled water system providing lower temperature water in response to low space relative humidity levels required. The following table lists available data on this chiller:

Table 3.4.6, Air Cooled Chiller

#	*Type*	*Tons*	*Condenser*	*Volts*	*Amps*
ACCH-1	Recip.	7	Air Cooled	460	26

Ventilation: Marshall Hall is ventilated through ten (10) individual air handling units. Air handling units are situated in equipment rooms strategically located within the building. All air handlers have provisions for heating and cooling, including enthalpy controlled economizers. Approximately 181,800 cfm of supply air and 48,800 cfm of outdoor air introduced through the air handling units. The following table lists air handler supply and outside air cfm:

Table 3.4.7, Air Handler cfm

AHU #	*Supply cfm*	*Min O.A. cfm*
1N	5,250	300
1S	11,900	3,250
2	35,600	11,370
3	18,000	5,655
4	11,040	9,810
5	26,400	5,675
6	44,750	5,565
7	5,600	2,400
8	21,300	4,570
9	2,000	265

In addition, there are five (5) fan coil units and two (2) computer room units serving selective isolated spaces in the building. The cafeteria kitchen hood has a dedicated 100% outdoor air make-up unit capable of tempering air only. This unit supplies 4,230 cfm of outside air to the kitchen.

The atrium area of Marshall Hall is equipped with a smoke removal system incorporating two (2) supply air fans and one (1) exhaust fan. The smoke removal system is activated by the building fire alarm system.

Seven (7) of the building air handling systems have variable air volume (VAV) terminal units. Building perimeter spaces and spaces with a roof have VAV terminals with hot water reheat coils for winter heating requirements. Interior building spaces have VAV terminals without reheat coils. VAV terminals without reheat coils control space temperature by varying air flow to the space served. The building balancing report indicates minimum air flows for these units to be 15% of the design supply air flow.

In general, VAV terminals with reheat coils vary air flows to maintain space temperature set points. Reheat coils are activated on a drop in space temperature below the set point. Minimum air flows for these units are either 30% or 100% of the design supply air flow, dependent on the area served.

Three (3) of the building air handling unit systems operate as single zone space temperature control.

<u>Building Exhausts:</u> Marshall Hall is a large complex with varied exhaust requirements. Building exhaust requirements include:

1. Equipment Rooms
2. Toilet Rooms
3. Cafeteria/Kitchen
4. Special Space Operations
5. Miscellaneous Building Operations

Exhaust systems for the entire building total approximately 109,400 cfm. Of this total, systems with an independent outdoor air source account for approximately 75,100 cfm. The remaining exhaust, approximately 34,300 cfm, is introduced through the air handling unit systems.

Domestic Hot Water: Marshall Hall's domestic hot water needs are met by a gas fired hot water generator. The table below summarizes information on the unit:

Table 3.4.8, Domestic Water Heater Schedule

Fuel	*MBH*	*Recovery, gph*	ΔT
Nat. Gas	1,400	1,631	100°F

Water is heated to and stored at 140°F, a blending station produces 120°F for general building use, and 140°F water is utilized by the cafeteria/kitchen area. Domestic hot water for the building is used for the restrooms, cafeteria/kitchen, locker rooms and general cleaning needs. The cafeteria/kitchen facility utilizes a 45 kW electric booster heater to meet higher dishwashing water temperature requirements of 180°F.

Controls: Marshall Hall control systems are by Robertshaw Controls Company. In addition to local space temperature controls, a building energy monitoring control system (EMCS) is present. The EMCS has the capability to control all major building HVAC components and monitor selective building functions. However, presently only air handler scheduling is mainly utilized.

3.5 Food Preparation

Meals: According to kitchen personnel, approximately 300 meals are prepared daily. The facility prepares breakfast and lunch five days a week. In general, the kitchen is occupied from 5:30 a.m. through 2:00 p.m.

Equipment: The facility employs a wide variety of electric and natural gas cooking equipment. Most of the larger equipment is gas-fired while smaller convenience equipment is electrically operated. The following table lists the major pieces of equipment:

Table 3.5.1, Major Kitchen Equipment

Equipment Type	*Quantity*	*Gas-Btuh*	*Electric-kW*
Convection Oven	1	100,000	
Convection Steamer	1	200,000	
Fryer	1	100,000	
Range/Oven	2	130,000	
Broiler	2	40,000	
Fryer	1		11.4
Griddle	1		12
Booster Heater	1		45
Char Broiler	1		10

3.6 Electrical

Service: Power is supplied to Fort McNair by the Potomac Electric Power Company by two (2) 13.2 kV high voltage radial feeders. The building is served under pepco's GT rate schedule.

Transformers: The two (2) 13.2 kV feeders, feed two (2) 2,000 kVA oil-filled unit substation transformers. A 480Y/277V/3 phase/600 hertz secondary building distribution is provided for building lighting and large equipment loads. 208Y/120V/3 phase/60 hertz dry type transformers are located on each floor level for building receptacles and small equipment loads.

Emergency Power: Marshall Hall's emergency power source is a 250 kW diesel fired generator.

Lighting: Lighting for Marshall Hall is accomplished predominantly through the use of fluorescent lighting luminaires of various sizes for the most part utilize 40 watt lamps. Certain areas and spaces within the building utilize H.I.D and incandescent fixtures. In general, lighting systems are wired for two (2) lighting level switching. Table 3.6.1 on the following page displays a luminaire schedule which was developed from design drawings. This will be used to identity luminaire types in the Light Model.

LUMINAIRE SCHEDULE
MARSHALL HALL
TABLE 3.6.1

Lum. Letter	Luminaire Type	Mounting	Lamps	Lum. Letter	Luminaire Type	Mounting	Lamps
A	2 x 4 Troffer	Recessed Lay-In	4-40	D1	Low Voltage	Recessed Ceiling	50
A1	2 x 4 Troffer	Recessed Lay-In	3-40	D2	Low Voltage	Recessed Ceiling	50
A2	2 x 4 Troffer	Recessed Lay-In	2-40	D3	LV Adjustable	Recessed Ceiling	25
A3	1 x 4 Troffer	Recessed Lay-In	2-40	D5	LV Track	Recessed Ceiling	50
A4	1 x 4 Troffer	Recessed Plaster	2-40	D6	Track Light	Recessed Track	150
A5	1 x 4 Industrial	Surface Pendant	2-40	D7	Shower Light	Recessed	9,13
A6	48" Strip	Surface In Cove	1-40	D8	Lamp Holder	Surface	100
A7	36" Strip	Surface In Cove	1-30	D9	Downlight	Recessed Ceiling	100
A8	24" Strip	Surface In Cove	1-20	D10	Dark Room	Recessed Ceiling	15,100
A9	2 x 2 Troffer	Recessed Lay-In	2-40	D11	Opal Downlight	Surface	100
A10	Shelf	Surface In Cabinet	2-13	D15	Downlight	Recessed Ceiling	18
A11	48" Strip	Recessed Ceiling	2-40	D16	40" Light Strip	----------	17-5
A12	2 x 4 Troffer	Recessed Ceiling	3-40	D17	92" Light Strip	----------	41-5
A13	2 x 4 Troffer	Recessed Ceiling	2-40	D18	118" Light Strip	----------	53-5
A14	Wall Luminaire	Surface Wall	2-40	E	Exit	Recessed Ceiling	2-8
A15	Indirect	Suspended Ceiling	2-40	E1	Exit	Recessed Ceiling	2-8
A16	48" Strip	Surface In Cove	1-40	E2	Exit	Recessed Wall	2-8
A17	1 x 4 Troffer	Recessed Grid	2-40	E3	Exit	Recessed Ceiling	2-8
A18	96" Strip	Surface In Cove	2-40	E4	Exit	Recessed Wall	2-8
A19	Kitchen 2 x 4	Recessed Ceiling	4-40	E5	Exit	Recessed Ceiling	2-8
A20	48" Strip	Surface In Cove	1-40	E6	Exit	Recessed Ceiling	2-8
A21	2 x 4 Troffer	Recessed Ceiling	4-40	E7	Exit	Recessed Wall	2-8
A22	36" Strip	Recessed Ceiling	2-30	F	HID Metal Halid	Surface	175
A23	Wall Bracket	Surface Wall	2-40	F1	HID Square	Recessed	175
A24	48" Strip	Surface In Cove	2-48	F3	HID Downlight	Recessed Ceiling	250
A25	2 x 2 Troffer	Surface Ceiling	2-40	F4	HID	Recessed Ceiling	75
A26	Plugging Strip	Suspended Ceiling	-	G	Walk Light	Recessed Wall	1-50
A27	33" Under Light	Surface	1-8,13	H	Spot Light	Track	1000
A28	mergency Ligh	Surface	2-36	H1	Artificial Light	Luminous Ceiling	12-40
A29	21" Task Light	Surface	1-13	S1	Parking Lot	Pole	250
B	Surface Wall	Surface Wall	2-13	S2	Walkway	Pole	100
C	Chandelier	Surface Atrium	2-250	S3	Step Light	Recessed Wall	50
C1	Chandelier	Suspended Ceiling	8-60	S4	3 Foot Bollard	Grade	150
C2	Chandelier	Suspended Ceiling	8-13	S5	Security Light	Pole	2-250
C3	Chandelier	Suspended Ceiling	1-250	S6	Tree Light	Grade	100
D	LV Adjustable	Recessed Ceiling	50	S7	Security Light	Pole	250

4.0 BILLING HISTORIES

4.1 General

The energy analysis for this report is based upon data during the 12-month period from October 1993 through September 1994. The total energy cost for Marshall Hall during that period was $444,600 and is distributed as follows:

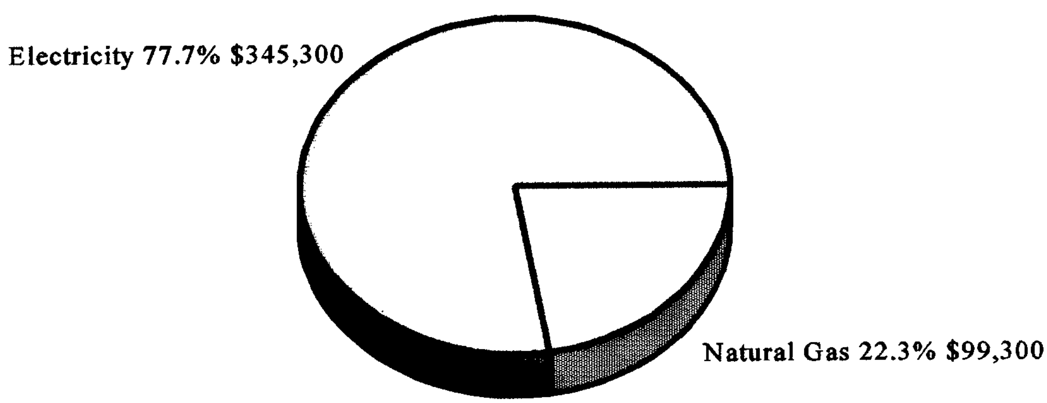
Table 4.1.1, Energy Cost Distribution

Electricity	$345,300
Natural Gas	$99,300
Total	$444,600

The annual energy cost distribution is graphically shown below in Figure 4.1.2.

Figure 4.1.2

Energy Cost Distribution



The total area for Marshall Hall, as identified in Section 3, is 243,450 sf. Based on the annual energy cost presented above, the energy cost per square foot for Marshall Hall is $1.83. Breakdown by fuel type is shown below in Table 4.1.3.

Table 4.1.3, Energy Cost Per sf

Electricity	$1.42
Natural Gas	$0.41
Total	$1.83

Entech has found most institutional buildings at approximately $1.00/sf to $1.30/sf (Table 4.1.3A). Marshall Halls costs are therefore above average. This primarily appears to be due to electricity. Typically, electric costs are approximately $0.70/sf.

Table 4.1.3A, Sample $/sf Listing

Institutions	*$*	*$/sf*	*Note*
Cabrini College	$246,500	$1.01	Gas/Oil Heat, A/C
Eastern College	$307,000	$0.99	Gas/Oil Heat, A/C
Immaculata College	$526,000	$0.94	Gas/Oil Heat, A/C
Moravian College	$528,000	$1.32	Electric Heat, A/C
Elizabethtown College	$529,000	$1.34	Electric Heat, A/C

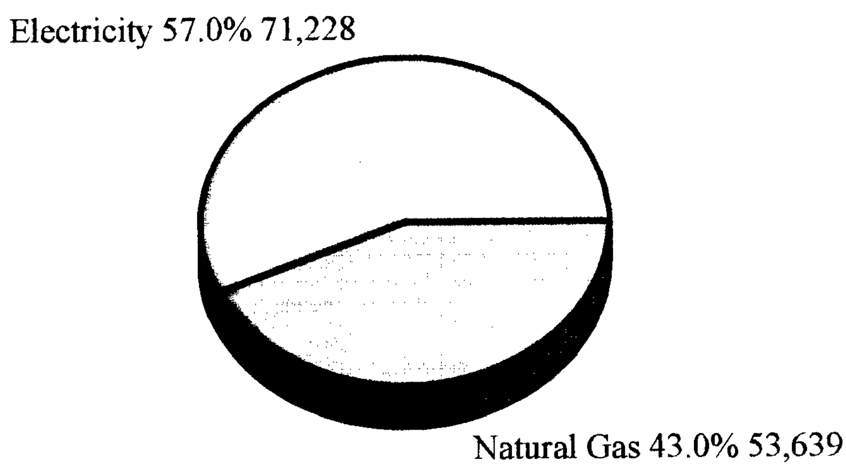
Another useful energy consumption indicator is point of use Btu's per square foot. As calculated below the energy usage per square foot for Marshall Hall is 124,867 (71,228 Btu/sf + 53,639 Btu/sf).

Electric (mmBtu)	=	17,340 mmBtu [(5,080,693 kWh x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu]
Gas (mmBtu)	=	13,058 mmBtu [(12,678 mcf x 1,030,000 Btu/mcf) ÷ 1,000,000 Btu/mmBtu]
Electric (Btu/sf)	=	71,228 Btu/sf [(5,080,693 kWh x 3,413 Btu/kWh) ÷ 243,450 sf]
Gas (Btu/sf)	=	53,639 Btu/sf [(12,678 mcf x 1,030,000 Btu/mcf) ÷ 243,450 sf]

Figure 4.1.4 below graphically shows the distribution between fuel types.

Figure 4.1.4

Energy Usage Distribution



This figure indicates that electricity accounts for 57% of the building energy usage while figure 4.1.2 shows electricity accounting for 78% of the cost. This means that natural gas provides more energy per dollar spent than electricity.

4.2 Electricity

Potomac Electric Power Company (pepco) provides power to Marshall Hall under the GT-3A rate (General Service, Time Metered). This rate is available to customers taking service at voltages between 4.16 kV and 33 kV. Table 4.2.1 on the following page displays the electric billing history for Marshall Hall during the past two years.

Table 4.2.1
Electric Billing History, 1992-93

Month	*Days*	*Max kW*	*On-Peak kW*	*Off-Peak kWh*	*Inter kWh*	*On-Peak kWh*	*Total kWh*	*Cost $*	*$/kWh*	*kWh/Day*	*mmBtu*
October, 1992	29	1,074	1,074	161,658	106,398	129,536	397,592	$32,605	$0.082	13,710	2,138
November	29	989	989	144,466	101,934	128,943	375,343	$19,290	$0.051	12,943	1,281
December	33	978	978	189,615	115,433	137,103	442,151	$20,483	$0.046	13,399	1,509
January, 1993	34	966	966	194,355	110,430	125,142	429,927	$20,579	$0.048	12,645	1,467
February	29	993	993	160,758	108,211	126,356	395,325	$19,970	$0.051	13,632	1,349
March	30	1,009	1,009	152,215	118,117	139,330	409,662	$20,784	$0.051	13,655	2,490
April	31	1,078	1,078	177,625	118,485	141,157	437,267	$22,308	$0.051	14,105	1,492
May	30	1,169	1,169	167,720	130,415	159,094	457,229	$24,182	$0.053	15,241	1,561
June	29	1,208	1,208	180,242	127,630	152,316	460,188	$38,333	$0.083	15,869	1,571
July	32	1,241	1,241	277,699	151,823	168,906	598,428	$43,729	$0.073	18,701	2,042
August	29	1,190	1,190	209,201	137,958	162,583	509,742	$40,605	$0.080	17,577	1,740
September	30	1,255	1,255	261,238	151,832	173,289	586,359	$46,056	$0.079	19,545	2,001
Total	365	13,150	13,150	2,276,792	1,478,666	1,743,755	5,499,213	$348,924	$0.063	15,066	18,769

Table 4.2.1 (continued)
Electric Billing History, 1993-94

Month	*Days*	*Max kW*	*On-Peak kW*	*Off-Peak kWh*	*Inter kWh*	*On-Peak kWh*	*Total kWh*	*Cost $*	*$/kWh*	*kWh/Day*	*mmBtu*
October, 1993	29	1,207	1,153	214,145	127,283	144,114	485,542	$39,995	$0.082	16,743	2,138
November	31	1,099	1,087	188,195	106,995	125,341	420,531	$23,096	$0.055	13,566	1,435
December	30	981	981	152,300	103,260	126,330	381,890	$19,808	$0.052	12,730	1,303
January, 1994	34	914	899	200,420	98,550	113,000	411,970	$20,018	$0.049	12,117	1,406
February	28	889	889	158,100	102,780	112,230	373,110	$20,366	$0.055	13,325	1,273
March	30	958	958	158,140	103,970	126,300	388,410	$21,213	$0.055	12,947	2,490
April	29	977	977	138,960	103,060	121,300	363,320	$20,939	$0.058	12,528	1,240
May	31	996	996	161,600	104,930	123,270	389,800	$22,731	$0.058	12,574	1,330
June	29	1,006	1,006	185,140	112,650	127,720	425,510	$35,677	$0.084	14,673	1,452
July	31	1,154	1,154	231,790	140,360	156,850	529,000	$42,706	$0.081	17,065	1,805
August	32	1,141	1,141	206,810	128,530	151,720	487,060	$40,925	$0.084	15,221	1,662
September	29	1,066	1,066	184,500	111,940	128,110	424,550	$37,810	$0.089	14,640	1,449
Total	363	12,388	12,307	2,180,100	1,344,308	1,556,285	5,080,693	$345,284	$0.068	13,996	17,340

4.2.1 Incremental Cost

Entech Engineering developed a Lotus spreadsheet computer program to determine the incremental cost for electricity. Using actual billing data, usage and demand are entered into the program, and the bill is calculated. The computer calculation should match the utility's bill.

To calculate the incremental cost for billing demand, the electric bill is re-calculated using one less kW of demand. The cost difference between the actual bill and the bill calculated with one less kW is considered to be the incremental cost for demand ($/kW).

The same procedure is performed for usage (kWh). The bill is calculated using one less kWh, with the difference in the two costs being the incremental usage cost ($/kWh). For this facility, the incremental cost for electricity is as follows:

Table 4.2.1.1, Incremental Costs

Incrementals	*Winter (Nov-May)*	*Summer (Jun-Oct)*
Demand, $/kW	$6.60	$17.09
Off-Peak, $/kWh	$0.037	$0.034
Interm., $/kWh	$0.046	$0.047
On-Peak, $/kWh	$0.053	$0.062

The incremental costs will be used in calculations of the electric and lighting models as described in Section 2.

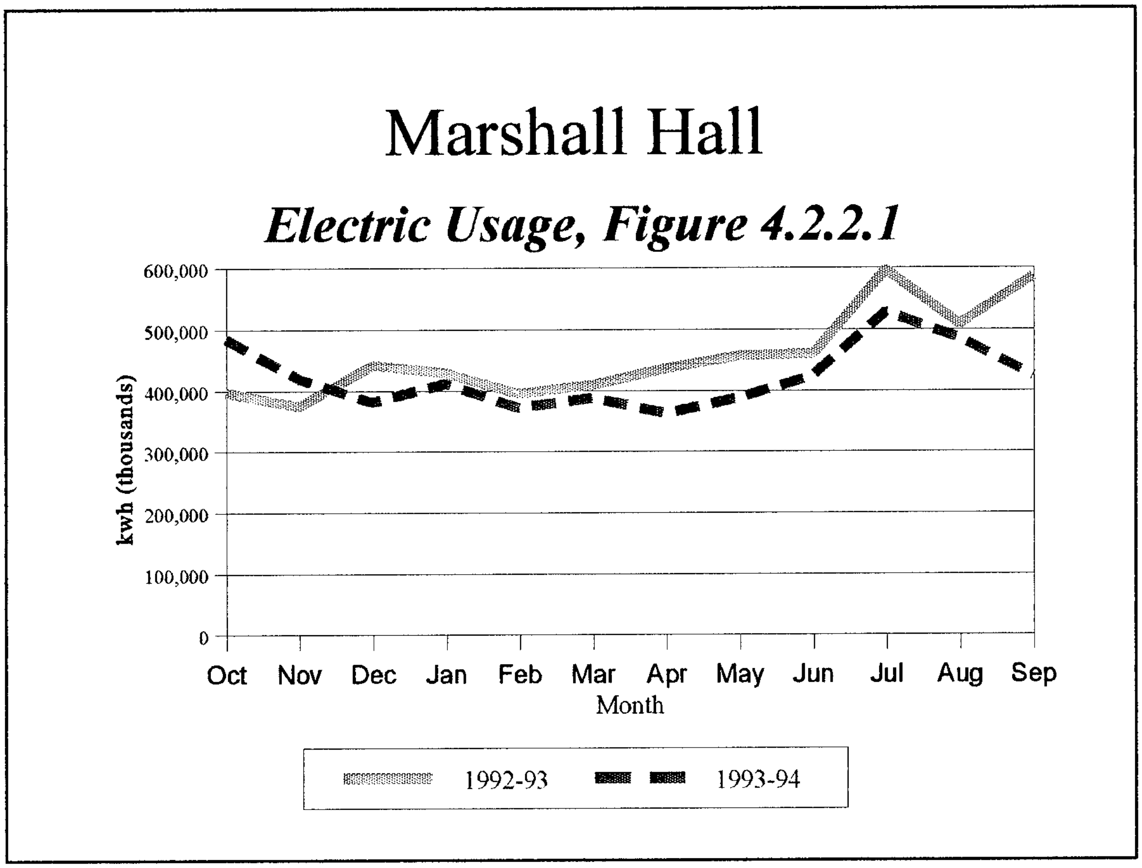
The use of incremental rates is reasonably accurate for calculating cost savings due to small changes in demand and usage (±25%) from existing levels. The use of incremental rates is less accurate in calculating cost savings with larger changes in demand and usage (>25%) and tends to underestimate savings slightly (usually < 2%). However, for the convenience of calculating the feasibility of various options, the use of incremental rates for demand and usage is either accurate or slightly conservative (savings not overestimated) and is therefore prudent.

Copies of the calculations of the incremental cost, and monthly electric bills are included in the Attachments 9.1 through 9.3.

4.2.2 Electric Usage

Electric usage is measured in kilowatt hours (kWh). One kWh is equivalent to the usage of 1,000 watts of electricity for one hour. Figure 4.2.2.1 graphically shows electrical usage profile of the Marshall Hall for the period of October 1992 through September 1994.

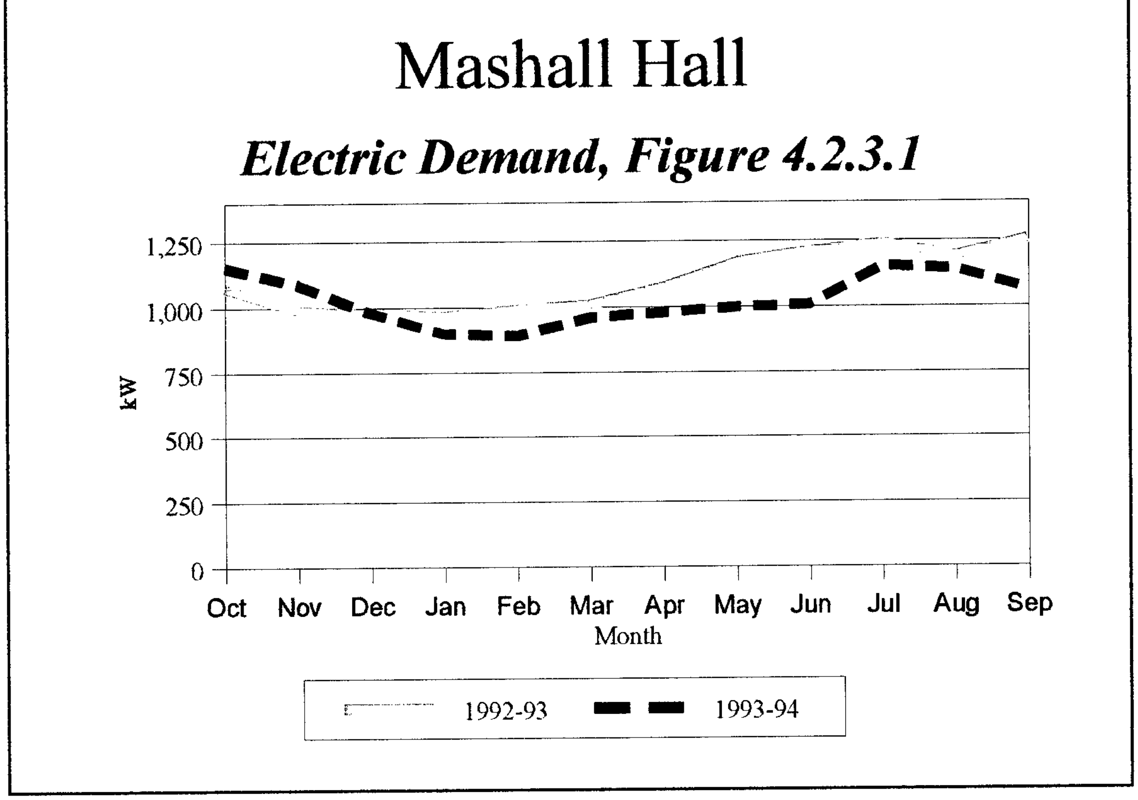
The graph indicates that electric usage follows a cooling curve. This is evident from the increases seen during the summer.



4.2.3 Monthly Demand

Electrical demand is the highest rate of electrical energy used during a specified time interval (normally 30 minutes). The measurement of electric demand is expressed as kilowatts (1,000 watts). Electrical demand is not necessarily related to the amount of time the electrical components are in operation. The monthly billing demand profile for Marshall Hall during the past year is graphically shown in Figure 4.2.3.

From Figure 4.2.3, it can be seen that the billed demand is fairly consistent during the winter months and increases as the warmer months are encountered.



4.3 Fuel Oil

Fuel oil is presently not used at Marshall Hall.

4.4 Natural Gas

Marshall Hall uses natural gas for space heating, cooking, domestic hot water, and humidification during the course of a year. Natural Gas is provided by Washington Gas Light Company under Rate Schedule #2 (Firm Service Other Than Residential). Table 4.4.1 below displays 1992-94 natural gas consumption.

Table 4.4.1, Marshall Hall Gas Usage

Month	*Usage (mcf)*	*Cost ($)*	*$ per mcf*	*mmBtu*
October, 1992			$0.00	
November	1,988	$15,270	$7.68	2,048
December	2,336	$19,172	$8.21	2,406
January, 1993	2,284	$18,319	$8.02	2,353
February	2,184	$17,249	$7.90	2,250
March	1,593	$12,272	$7.70	17,239
April	1,276	$10,037	$7.87	1,314
May	672	$5,371	$7.99	692
June	507	$4,209	$8.30	522
July	258	$2,190	$8.49	266
August	541	$4,203	$7.77	557
September	860	$5,601	$6.51	886
Totals	14,499	$113,893	$7.86	14,934

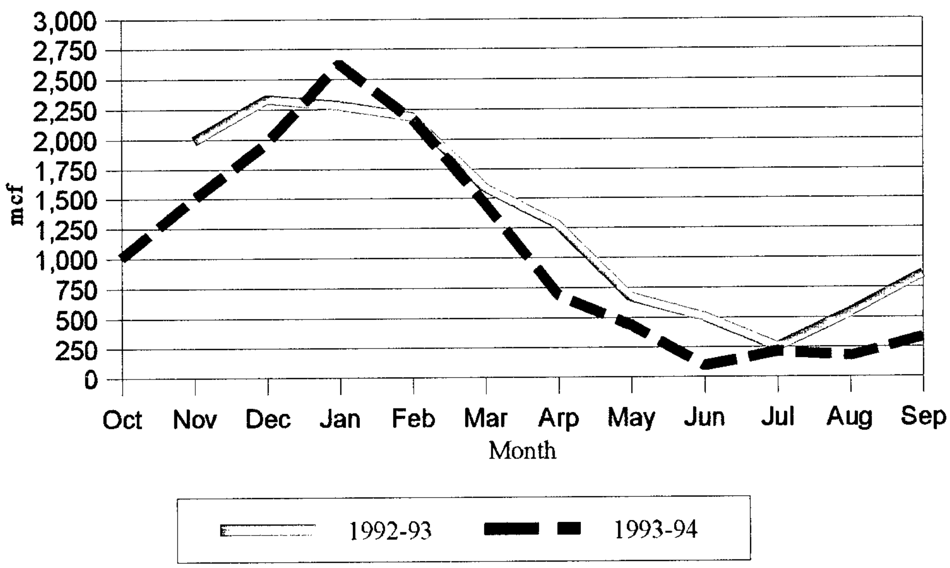
Table 4.4.1 (Continued)

Month	*Usage (mcf)*	*Cost ($)*	*$ per mcf*	*mmBtu*
October, 1993	1,003	$7,721	$7.70	1,033
November	1,501	$11,652	$7.76	1,546
December	1,968	$15,039	$7.64	2,027
January, 1994	2,627	$20,600	$7.84	2,706
February	2,171	$17,460	$8.04	2,236
March	1,453	$11,485	$7.90	1,497
April	692	$5,606	$8.10	713
May	441	$3,527	$8.00	454
June	97	$726	$7.48	100
July	212	$1,612	$7.60	218
August	176	$1,312	$7.45	181
September	338	$2,553	$7.55	348
Totals	12,679	$99,293	$7.83	13,059

Figure 4.4.2 on the following page graphically displays gas consumption for the past two years.

Marshall Hall

Natural Gas Usage, Figure 4.4.2



5.0 ENERGY CALCULATIONS

5.1 General

Currently, Marshall Hall is individually metered for electric and gas consumption. However, when conducting a detailed energy study of a single building, it is essential to estimate the energy consumption patterns for equipment, systems, and areas. Energy usage of equipment, building areas, and systems will be calculated throughout this section as described in the Methodology Section. The light model, electric model, heat loss model, EZDOE as well as other estimating tools will be employed during this task.

All estimated results will become the basis for subsequent Energy Conservation Opportunities during later sections of this report..

5.2 Lighting Model

Entech calculated a lighting model for Marshall Hall based upon information collected during walk-through and from drawings obtained during the study. The light model is shown on the following pages in Table 5.2.1 and represents a typical month in which the winter electric rates are in effect. From the light model, the average watts per square foot for the building is 1.9 (470,603 watts ÷ 243,450 sf) which is average for most facilities. Overall, Entech found the lighting levels to be adequate. Table 5.2.2 on the following page summarizes the results of the light model.

Lighting Model For Typical Winter Month
Marshall Hall
Table 5.2.1

Room or Area Description	Luminaire Type (1)		Light Levels (FC)	No. Of Lum.	Lamps Per Luminaire	Watts Per Lamp	Total Watts	Off-Peak Time Period: hrs Per Week	Off-Peak Time Period: Off-Peak Kwh Per Month	Intermediate Time Period: hrs Per Week	Intermediate Time Period: Inter. Kwh Per Month	On-Peak Time Period: hrs Per Week	On-Peak Time Period: On-Peak Kwh Per Month	Percent Of Kw On-Peak	Demand Kw On-Peak	Total Kwh Per Month	Electric Costs: Monthly Demand (Kw)	Electric Costs: Monthly Usage (Kwh)	Electric Costs: Monthly Cost $
AHU-1N & AHU-1S																			
Ground Floor:																			
Lobby & Vestibules	A16	1.15		20	1	40	920	5	20	20	80	30	120	95.0%	0.9	219	$5.77	$10.74	$16.51
Lobby & Vestibules	F4	1.15		22	1	75	1,898	5	41	20	164	30	247	95.0%	1.8	452	$11.90	$22.16	$34.06
Lobby & Vestibules	D15	1.15		11	1	18	228	5	5	20	20	30	30	95.0%	0.2	54	$1.43	$2.66	$4.09
Lobby & Vestibules		1.15		13	1	13	194	5	4	20	17	30	25	95.0%	0.2	46	$1.22	$2.27	$3.49
Lobby & Vestibules	D1	1		35	1	50	1,750	5	38	20	152	30	228	95.0%	1.7	417	$10.97	$20.44	$31.41
(Exit Sign)		1.15		4	2	8	74	88	28	40	13	40	13	95.0%	0.1	54	$0.46	$2.30	$2.76
Second Floor:											0		0						
205, Corridor		1.15		3	2	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
(Exit Sign)	E6	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
Sub-Totals							**5,358**		**149**		**472**		**700**		**5.1**	**1,322**	**$33.59**	**$64.37**	**$97.96**
AHU-2																			
Ground Floor:											0		0						
170, Workroom	A1	1.15	65	21	3	40	2,898	0	0	20	251	30	377	95.0%	2.8	628	$18.17	$31.52	$49.69
170A, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
170B, Conference	A1	1.15		3	3	40	414	0	0	10	18	10	18	90.0%	0.4	36	$2.46	$1.78	$4.24
170C, Storage	A2	1.15		2	2	40	184	0	0	1	1	1	1	40.0%	0.1	2	$0.49	$0.08	$0.56
171, Bookstore	A9	1.15		13	2	40	1,196	5	26	20	104	30	155	95.0%	1.1	285	$7.50	$13.97	$21.47
171A, Storage	A2	1.15		1	2	40	92	0	0	2	1	2	1	10.0%	0.0	2	$0.06	$0.08	$0.14
172, Supply	A2	1.15		4	2	40	368	0	0	5	8	5	8	70.0%	0.3	16	$1.70	$0.79	$2.49
173, Mail Room	A1	1.15	40	11	3	40	1,518	5	33	20	132	30	197	95.0%	1.4	362	$9.52	$17.73	$27.25
173A, Office	A1	1.15		1	3	40	138	5	3	20	12	30	18	95.0%	0.1	33	$0.87	$1.61	$2.48
174, Pick Up	A1	1.15	45	6	3	40	828	5	18	20	72	30	108	95.0%	0.8	197	$5.19	$9.67	$14.86
174A, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
174B, Office Area	A1	1.15	40	9	3	40	1,242	5	27	20	108	30	161	95.0%	1.2	296	$7.79	$14.50	$22.29
174C, Office	A1	1.15		4	3	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
174D, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
175, Store Room	A5	1.15	30	35	2	40	3,220	0	0	20	279	30	419	95.0%	3.1	698	$20.19	$35.02	$55.21
176, Breakout	A5	1.15		4	2	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
176A, Loading Area	F1	1.15		28	1	175	5,635	88	2,149	40	977	40	977	95.0%	5.4	4,102	$35.33	$176.20	$211.53
176A, Loading Area	A5	1.15		1	2	40	92	88	35	40	16	40	16	95.0%	0.1	67	$0.58	$2.88	$3.45
Corridor	A9	1.15		15	2	40	1,380	5	30	20	120	30	179	95.0%	1.3	329	$8.65	$16.12	$24.77
(Exit Sign)	E6	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
177, Reception	A2	1.15		5	2	40	460	5	10	20	40	30	60	95.0%	0.4	110	$2.88	$5.37	$8.26
177A, Office	A2	1.15		2	2	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
177B, Office	A2	1.15		2	2	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
177C, Office	A2	1.15		4	2	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
177D, Office	A2	1.15		2	2	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
178, Classroom	A9	1.15		20	2	40	1,840	5	40	20	159	30	239	95.0%	1.7	439	$11.54	$21.49	$33.02
178, Classroom	D9	1		16	1	100	1,600	5	35	20	139	30	208	95.0%	1.5	381	$10.03	$18.69	$28.72
179, Storage	A2	1.15		2	2	40	184	0	0	2	2	2	2	10.0%	0.0	3	$0.12	$0.16	$0.28
179A, Elevator Machine Room	A5	1.15		2	2	40	184	0	0	2	2	2	2	5.0%	0.0	3	$0.06	$0.16	$0.22
180, Holding	A2	1.15		2	2	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
181, Print Work Room	A	1.15	65	21	4	40	3,864	5	84	20	335	30	502	95.0%	3.7	921	$24.23	$45.13	$69.35
181, Print Work Room	A	1.15		2	2	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
181A, B & W Meg. Process	D10	1		3	1	100	300	5	7	20	26	30	39	95.0%	0.3	72	$1.88	$3.50	$5.38
181B, B & W Meg. Process	D10	1		1	1	100	100	5	2	20	9	30	13	95.0%	0.1	24	$0.63	$1.17	$1.79
181C, Litho Camera	D10	1		2	1	100	200	5	4	20	17	30	26	95.0%	0.2	48	$1.25	$2.34	$3.59
181D, Portrait Studio	A25	1.15	55	3	2	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
181E, B & W Print Process	D10	1		2	1	100	200	5	4	20	17	30	26	95.0%	0.2	48	$1.25	$2.34	$3.59
181F, Janitor's Closet	A1	1.15		1	3	40	138	5	3	20	12	30	18	95.0%	0.1	33	$0.87	$1.61	$2.48
181G, Porox. Camera	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
181H, Color Room	A	1.15		3	4	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
181I, Pick Up Room	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
181J, Camera Room	A	1.15		1	4	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
181K, Slide Mounting	A	1.15		1	4	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
181L, Film Viewing	A	1.15		1	4	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
181M, Viewing	D10	1		1	1	100	100	5	2	20	9	30	13	95.0%	0.1	24	$0.63	$1.17	$1.79
183, Corridor	A9	1.15		14	2	40	1,288	5	28	20	112	30	167	95.0%	1.2	307	$8.08	$15.04	$23.12
(Exit Sign)	E6	1.15		4	2	8	74	88	28	40	13	40	13	95.0%	0.1	54	$0.46	$2.30	$2.76
183A, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
183B, A.V. Control	A	1.15	40	6	4	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
183C, Studio	A5	1.15	60	9	2	40	828	5	18	20	72	30	108	95.0%	0.8	197	$5.19	$9.67	$14.86
183D, Storage	A2	1.15		4	2	40	368	0	0	2	3	2	3	10.0%	0.0	6	$0.24	$0.32	$0.56
183E, Typesetting	A1	1.15	35	8	3	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
183E-2, Office	A	1.15		1	4	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
183F, Graphic Arts	A1	1.15	50	20	3	40	2,760	5	60	20	239	30	359	95.0%	2.6	658	$17.31	$32.23	$49.54

Lighting Model For Typical Winter Month
Marshall Hall
Table 5.2.1

Room or Area Description	Luminaire Type (1)		Light Levels (FC)	No. Of Lum.	Lamps Per Luminaire	Watts Per Lamp	Total Watts	Off-Peak Time Period: hrs Per Week	Off-Peak Time Period: Off-Peak Kwh Per Month	Intermediate Time Period: hrs Per Week	Intermediate Time Period: Inter. Kwh Per Month	On-Peak Time Period: hrs Per Week	On-Peak Time Period: On-Peak Kwh Per Month	Percent Of Kw On-Peak	Demand Kw On-Peak	Total Kwh Per Month	Electric Costs: Monthly Demand (Kw)	Electric Costs: Monthly Usage (Kwh)	Electric Costs: Monthly Cost $
183F-2, Work Room	A	1.15	45	12	4	40	2,208	5	48	20	191	30	287	95.0%	2.1	526	$13.84	$25.79	$39.63
183G, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
183H, Conference	A	1.15		4	4	40	736	0	0	20	64	30	96	95.0%	0.7	159	$4.61	$8.01	$12.62
183I, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
183J, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
183K, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
183L, Printing	A	1.15	25	27	4	40	4,968	5	108	20	431	30	646	95.0%	4.7	1,184	$31.15	$58.02	$89.17
(Exit Sign)	E6	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
183M, Pick Up Room	A1	1.15		4	3	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
183N, Files	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
183O, Office Area	A1	1.15		7	3	40	966	5	21	20	84	30	126	95.0%	0.9	230	$6.06	$11.28	$17.34
183P, Corridor	A9	1.15		2	2	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
Men's Room	A11	1.15		9	2	40	828	5	18	20	72	30	108	95.0%	0.8	197	$5.19	$9.67	$14.86
Women's Room	A11	1.15		12	2	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
198, Stress Testing	A2	1.15		15	2	40	1,380	5	30	20	120	30	179	95.0%	1.3	329	$8.65	$16.12	$24.77
198A, Locker Room	A4	1.15		10	2	40	920	5	20	20	80	30	120	95.0%	0.9	219	$5.77	$10.74	$16.51
198A, Locker Room	D7	1.15		6	1	9	62	5	1	20	5	30	8	95.0%	0.1	15	$0.39	$0.73	$1.11
198B, Security Desk	A1	1.15		3	3	40	414	88	158	40	72	40	72	95.0%	0.4	301	$2.60	$12.95	$15.54
199, Exercise Room	A1	1.15		9	2	40	828	5	18	20	72	30	108	95.0%	0.8	197	$5.19	$9.67	$14.86
Corridor #1	A9	1.15	15	11	2	40	1,012	5	22	20	88	30	132	95.0%	1.0	241	$6.35	$11.82	$18.16
Corridor #1	D15	1.15		6	1	18	124	5	3	20	11	30	16	95.0%	0.1	30	$0.78	$1.45	$2.23
(Exit Sign)		1.15		5	2	8	92	88	35	40	16	40	16	95.0%	0.1	67	$0.58	$2.88	$3.45
Corridor #2	A9	1.15	10	15	2	40	1,380	5	30	20	120	30	179	95.0%	1.3	329	$8.65	$16.12	$24.77
Corridor #2	D15	1.15		14	1	18	290	5	6	20	25	30	38	95.0%	0.3	69	$1.82	$3.38	$5.20
(Exit Sign)		1.15		5	2	8	92	88	35	40	16	40	16	95.0%	0.1	67	$0.58	$2.88	$3.45
Cloorido r#3	A9	1.15	15	14	2	40	1,288	5	28	20	112	30	167	95.0%	1.2	307	$8.08	$15.04	$23.12
Cloorido r#3	D15	1.15		7	1	18	145	5	3	20	13	30	19	95.0%	0.1	35	$0.91	$1.69	$2.60
(Exit Sign)		1.15		5	2	8	92	88	35	40	16	40	16	95.0%	0.1	67	$0.58	$2.88	$3.45
Corridor #4	A9	1.15	20	13	2	40	1,196	5	26	20	104	40	207	95.0%	1.1	337	$7.50	$16.71	$24.21
(Exit Sign)		1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
Sub-totals							**64,232**		**3,578**		**6,017**		**8,489**		**60.1**	**18,084.4**	**$396.62**	**$859.10**	**$1,255.72**
AHU-3																			
Ground Floor:																			
184, Classroom	A13	1.15	40	20	2	40	1,840	0	0	20	159	30	239	95.0%	1.7	399	$11.54	$20.01	$31.55
184, Classroom	D15	1.15	40	2	1	18	41	0	0	20	4	30	5	95.0%	0.0	9	$0.26	$0.45	$0.71
184, Classroom	D9	1		19	1	100	1,900	0	0	20	165	30	247	95.0%	1.8	412	$11.91	$20.67	$32.58
184, Classroom	D6	1		8	1	150	1,200	0	0	20	104	30	156	95.0%	1.1	260	$7.52	$13.05	$20.58
(Exit Sign)	E6	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
185, A.V. Room	A1	1.15		10	3	40	1,380	0	0	20	120	30	179	95.0%	1.3	299	$8.65	$15.01	$23.66
185, A.V. Room	A11	1.15		3	2	40	276	0	0	20	24	30	36	95.0%	0.3	60	$1.73	$3.00	$4.73
185A, Storage	A5	1.15		1	2	40	92	0	0	2	1	2	1	10.0%	0.0	2	$0.06	$0.08	$0.14
186, Classroom	A13	1.15	40	22	2	40	2,024	0	0	20	175	30	263	95.0%	1.9	439	$12.69	$22.01	$34.70
186, Classroom	D15	1.15		2	1	18	41	0	0	20	4	30	5	95.0%	0.0	9	$0.26	$0.45	$0.71
186, Classroom	D9	1		26	1	100	2,600	0	0	20	225	30	338	95.0%	2.5	563	$16.30	$28.28	$44.58
186, Classroom	D6	1		8	1	150	1,200	0	0	20	104	30	156	95.0%	1.1	260	$7.52	$13.05	$20.58
(Exit Sign)	E6	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
186A, Closet	A2	1.15		2	2	40	184	0	0	2	2	2	2	10.0%	0.0	3	$0.12	$0.16	$0.28
186B, Closet	A2	1.15		1	2	40	92	0	0	2	1	2	1	10.0%	0.0	2	$0.06	$0.08	$0.14
186C, Closet	A2	1.15		1	2	40	92	0	0	2	1	2	1	10.0%	0.0	2	$0.06	$0.08	$0.14
187, Classroom	A13	1.15		22	2	40	2,024	0	0	20	175	30	263	95.0%	1.9	439	$12.69	$22.01	$34.70
187, Classroom	D15	1.15		2	1	18	41	0	0	20	4	30	5	95.0%	0.0	9	$0.26	$0.45	$0.71
187, Classroom	D9	1		22	1	100	2,200	0	0	20	191	30	286	95.0%	2.1	477	$13.79	$23.93	$37.72
(Exit Sign)	E6	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
188, Office Area	A1	1.15	40	22	3	40	3,036	5	66	20	263	30	395	95.0%	2.9	724	$19.04	$35.46	$54.49
188, Office Area	A	1.15		3	2	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
(Exit Sign)	E6	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
188A, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
189, Storage	A5	1.15		1	2	40	92	0	0	2	1	2	1	10.0%	0.0	2	$0.06	$0.08	$0.14
190, Storage	A2	1.15		3	2	40	276	0	0	2	2	2	2	10.0%	0.0	5	$0.18	$0.24	$0.42
191, Telephones	A2	1.15		3	2	40	276	0	0	20	24	30	36	95.0%	0.3	60	$1.73	$3.00	$4.73
193, Storage	A2	1.15		3	2	40	276	0	0	2	2	2	2	10.0%	0.0	5	$0.18	$0.24	$0.42
194, Holding	A	1.15		2	3	40	276	0	0	20	24	30	36	95.0%	0.3	60	$1.73	$3.00	$4.73
194A, Elevator Machine Room	A5	1.15		1	2	40	92	0	0	2	1	2	1	5.0%	0.0	2	$0.03	$0.08	$0.11
194B, Storage	A2	1.15		1	2	40	92	0	0	2	1	2	1	10.0%	0.0	2	$0.06	$0.08	$0.14
196, Classroom	A13	1.15	45	22	2	40	2,024	0	0	20	175	30	263	95.0%	1.9	439	$12.69	$22.01	$34.70
196, Classroom	D15	1.15		2	1	18	41	0	0	20	4	30	5	95.0%	0.0	9	$0.26	$0.45	$0.71
196, Classroom	D9	1		26	1	100	2,600	0	0	20	225	30	338	95.0%	2.5	563	$16.30	$28.28	$44.58
196, Classroom	D6	1		8	1	150	1,200	0	0	20	104	30	156	95.0%	1.1	260	$7.52	$13.05	$20.58

Lighting Model For [illegible]ical Winter Month
Marshall Hall
Table 5.2.1

Room or Area Description	Luminaire Type (1)		Light Levels (FC)	No. Of Lum.	Lamps Per Luminaire	Watts Per Lamp	Total Watts	Off-Peak Time Period: hrs Per Week	Off-Peak Time Period: Off-Peak Kwh Per Month	Intermediate Time Period: hrs Per Week	Intermediate Time Period: Inter. Kwh Per Month	On-Peak Time Period: hrs Per Week	On-Peak Time Period: On-Peak Kwh Per Month	Percent Of Kw On-Peak	Demand Kw On-Peak	Total Kwh Per Month	Electric Costs: Monthly Demand (Kw)	Electric Costs: Monthly Usage (Kwh)	Electric Costs: Monthly Cost $
(Exit Sign)	E6	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
197, Classroom	A13	1.15	40	16	2	40	1,472	0	0	20	128	30	191	95.0%	1.4	319	$9.23	$16.01	$25.24
197, Classroom	D15	1.15		2	1	18	41	0	0	20	4	30	5	95.0%	0.0	9	$0.26	$0.45	$0.71
197, Classroom	D9	1		18	1	100	1,800	0	0	20	156	30	234	95.0%	1.7	390	$11.29	$19.58	$30.86
197, Classroom	D6	1		8	1	150	1,200	0	0	20	104	30	156	95.0%	1.1	260	$7.52	$13.05	$20.58
(Exit Sign)	E6	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
197A, Closet	A5	1.15		1	2	40	92	0	0	2	1	2	1	10.0%	0.0	2	$0.06	$0.08	$0.14
197B, Closet	A5	1.15		1	2	40	92	0	0	2	1	2	1	10.0%	0.0	2	$0.06	$0.08	$0.14
Second Floor:													0						
242, Reading Room	A	1.15	25	8	4	40	1,472	0	0	20	128	30	191	95.0%	1.4	319	$9.23	$16.01	$25.24
242A, Mechanical Room	A5	1.15	25	12	2	40	1,104	0	0	20	96	30	144	95.0%	1.0	239	$6.92	$12.01	$18.93
242B, Corridor	A2	1.15		8	2	40	736	0	0	20	64	30	96	95.0%	0.7	159	$4.61	$8.01	$12.62
242B, Corridor	D15	1.15		3	1	18	62	0	0	20	5	30	8	95.0%	0.1	13	$0.39	$0.68	$1.06
243, Group Viewing	A1	1.15		12	3	40	1,656	0	0	20	144	30	215	95.0%	1.6	359	$10.38	$18.01	$28.39
243, Group Viewing	D9	1		8	1	100	800	0	0	20	69	30	104	95.0%	0.8	173	$5.02	$8.70	$13.72
244, Reserve Books	A	1.15		60	2	40	5,520	0	0	20	478	30	718	95.0%	5.2	1,196	$34.61	$60.04	$94.65
245, Office Area	A	1.15	40	27	4	40	4,968	5	108	20	431	30	646	95.0%	4.7	1,184	$31.15	$58.02	$89.17
245, Office Area	A	1.15		2	2	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
(Exit Sign)	E3	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
245A, Work Room	A1	1.15		5	3	40	690	5	15	20	60	30	90	95.0%	0.7	164	$4.33	$8.06	$12.38
245B, Office	A	1.15		1	4	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
245C, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
245D, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
245F, Telephone Closet	A5	1.15		1	2	40	92	0	0	2	1	2	1	5.0%	0.0	2	$0.03	$0.08	$0.11
245G, Electrical Closet	A5	1.15		1	2	40	92	0	0	2	1	2	1	5.0%	0.0	2	$0.03	$0.08	$0.11
246, Office	A1	1.15		3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
247, Closet	A14	1.15		2	2	40	184	0	0	2	2	2	2	10.0%	0.0	3	$0.12	$0.16	$0.28
249, Holding	A2	1.15		2	2	40	184	0	0	20	16	30	24	95.0%	0.2	40	$1.15	$2.00	$3.15
249A, Elevator Machine Room	A5	1.15		1	2	40	92	0	0	2	1	2	1	5.0%	0.0	2	$0.03	$0.08	$0.11
Third Floor:																			
331, Conference	A	1.15	85	6	4	40	1,104	0	0	10	48	10	48	50.0%	0.6	96	$3.64	$4.74	$8.38
332, Conference	A	1.15	85	6	4	40	1,104	0	0	10	48	10	48	50.0%	0.6	96	$3.64	$4.74	$8.38
333, Office Area	A1	1.15	50	18	3	40	2,484	5	54	20	215	30	323	95.0%	2.4	592	$15.57	$29.01	$44.58
(Exit Sign)	E3	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
333A, Office	A	1.15		3	4	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
333B, Office	A1	1.15		3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
333D, Telephone Closet	A5	1.15		1	2	40	92	0	0	2	1	2	1	5.0%	0.0	2	$0.03	$0.08	$0.11
333E, Electrical Closet	A5	1.15		2	2	40	184	0	0	2	2	2	2	10.0%	0.0	3	$0.12	$0.16	$0.28
333F, Supplies	A5	1.15		1	2	40	92	0	0	10	4	10	4	50.0%	0.0	8	$0.30	$0.39	$0.70
333G, Corridor	A9	1.15		3	2	40	276	0	0	20	24	30	36	95.0%	0.3	60	$1.73	$3.00	$4.73
334, Holding	A2	1.15		2	2	40	184	0	0	20	16	30	24	95.0%	0.2	40	$1.15	$2.00	$3.15
334A, Storage	A5	1.15		2	2	40	184	0	0	2	2	2	2	10.0%	0.0	3	$0.12	$0.16	$0.28
335, Library	A17	1.15		67	2	40	6,164	5	134	20	534	30	801	95.0%	5.9	1,469	$38.65	$71.99	$110.63
335A, Study Room	A2	1.15		2	2	40	184	0	0	20	16	30	24	95.0%	0.2	40	$1.15	$2.00	$3.15
Sub-totals							65,186		533		5,384		7,995		58.8	13,912	$388.32	$691.11	$1,079.43
AHU-4																			
Ground Floor:																			
155A, Multi-Purpose Room	A7	1.15	30	96	1	30	3,312	0	0	20	287	30	431	95.0%	3.1	718	$20.77	$36.02	$56.79
155A, Multi-Purpose Room	C1	1		8	8	60	3,840	0	0	20	333	30	499	95.0%	3.6	832	$24.08	$41.77	$65.84
(Exit Sign)	E6	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
155B, Multi-Purpose Room	A7	1.15	30	192	1	30	6,624	0	0	20	574	30	861	95.0%	6.3	1,435	$41.53	$72.05	$113.58
155B, Multi-Purpose Room	C1	1		16	8	60	7,680	0	0	20	666	30	998	95.0%	7.3	1,664	$48.15	$83.53	$131.69
(Exit Sign)	E6	1.15		4	2	8	74	88	28	40	13	40	13	95.0%	0.1	54	$0.46	$2.30	$2.76
155A, Multi-Purpose Room	A7	1.15	30	96	1	30	3,312	0	0	20	287	30	431	95.0%	3.1	718	$20.77	$36.02	$56.79
155A, Multi-Purpose Room	C1	1		8	8	60	3,840	0	0	20	333	30	499	95.0%	3.6	832	$24.08	$41.77	$65.84
(Exit Sign)	E6	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
Sub-totals							28,755		56		2,505		3,745		27.3	6,306	$180.30	$315.76	$496.06
AHU-5																			
Ground Floor:																			
114, Elevator Machine Room	A5	1.15		1	2	40	92	0	0	2	1	2	1	5.0%	0.0	2	$0.03	$0.08	$0.11
115, Men's Room	A11	1.15		9	2	40	828	5	18	20	72	30	108	95.0%	0.8	197	$5.19	$9.67	$14.86
115, Men's Room	D15	1.15		1	1	18	21	5	0	20	2	30	3	95.0%	0.0	5	$0.13	$0.24	$0.37
116, Women's Room	A11	1.15		10	2	40	920	5	20	20	80	30	120	95.0%	0.9	219	$5.77	$10.74	$16.51
116, Women's Room	D15	1.15		1	1	18	21	5	0	20	2	30	3	95.0%	0.0	5	$0.13	$0.24	$0.37
117, Janitor's Closet	D9	1		1	1	100	100	0	0	2	1	2	1	5.0%	0.0	2	$0.03	$0.09	$0.12
118, Telephone Closet	A5	1.15		4	2	40	368	0	0	2	3	2	3	5.0%	0.0	6	$0.12	$0.32	$0.44
119, Office	A	1.15	25	3	4	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
120, Office	A	1.15	25	3	4	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91

Lighting Model For Typical Winter Month

Marshall Hall

Table 5.2.1

Room or Area Description	Luminaire Type (1)		Light Levels (FC)	No. Of Lum.	Lamps Per Luminaire	Watts Per Lamp	Total Watts	Off-Peak Time Period hrs Per Week	Off-Peak Kwh Per Month	Intermediate Time Period hrs Per Week	Inter. Kwh Per Month	On-Peak Time Period hrs Per Week	On-Peak Kwh Per Month	Percent Of Kw On-Peak	Demand Kw On-Peak	Total Kwh Per Month	Electric Costs Monthly Demand (Kw)	Monthly Usage (Kwh)	Monthly Cost $
121, Office	A	1.15		3	4	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
122, Open Office Area		1.15		6	4	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
123, Corridor		1.15		21	2	40	1,932	5	42	20	167	30	251	95.0%	1.8	460	$12.11	$22.56	$34.68
(Exit Sign)		1.15		3	2	8	55	88	21	40	10	40	10	95.0%	0.1	40	$0.35	$1.73	$2.07
124, Office	A5	1.15		3	4	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
124A, Storage	A9	1.15		1	2	40	92	0	0	2	1	2	1	5.0%	0.0	2	$0.03	$0.08	$0.11
124B, Electrical Closet	A11	1.15		2	2	40	184	0	0	2	2	2	2	5.0%	0.0	3	$0.06	$0.16	$0.22
125, Passageway	A9	1.15		2	2	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
125, Passageway	A1	1.15		1	3	40	138	5	3	20	12	30	18	95.0%	0.1	33	$0.87	$1.61	$2.48
(Exit Sign)	E1	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
126, Office	A1	1.15	60	3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
127, Office	A1	1.15	60	3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
128, Office	A1	1.15	60	3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
129, Office	A1	1.15	60	3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
130, Office	A1	1.15	60	3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
131, Office	A1	1.15	60	3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
132, Office	A1	1.15	60	3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
133, Office	A1	1.15	60	3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
134, Office	A1	1.15	60	3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
135, Office	A1	1.15	60	3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
136, Office	A	1.15	60	2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
137, Office	A	1.15	60	2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
138, Office	A	1.15	60	2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
139, Office	A	1.15	60	2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
140, Office	A	1.15	60	2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
141, Office	A	1.15	60	2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
142, Office	A	1.15	60	2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
143, Mail Room	A	1.15		3	4	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
144, Office	A1	1.15	55	4	3	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
144A, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
144B, Office	A	1.15	55	6	4	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
144C, Office	A	1.15	55	6	4	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
145, Office	A1	1.15	40	8	3	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
146, Office	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
147, Office	A	1.15	40	2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
148, Office	A	1.15	40	2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
149, Office	A	1.15	40	2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
150, Office	A	1.15	40	2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
151, Office	A	1.15		3	4	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
152, Library/Class	A	1.15	30	10	4	40	1,840	5	40	20	159	30	239	95.0%	1.7	439	$11.54	$21.49	$33.02
152B, Open Office Area/Corridor	A	1.15		12	4	40	2,208	5	48	20	191	30	287	95.0%	2.1	526	$13.84	$25.79	$39.63
152B, Open Office Area/Corridor	A9	1.15		2	2	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
(Exit Sign)	E6	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
153, Mechanical Room	A	1.15	30	6	2	40	552	0	0	20	48	30	72	95.0%	0.5	120	$3.46	$6.00	$9.46
153A, Passageway	A5	1.15		2	2	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
(Exit Sign)	E6	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
Second Floor:																			
206, Men's Room	A11	1.15		6	2	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
206, Men's Room	D15	1.15		1	1	18	21	5	0	20	2	30	3	95.0%	0.0	5	$0.13	$0.24	$0.37
207, Women's Room	A11	1.15		7	2	40	644	5	14	20	56	30	84	95.0%	0.6	153	$4.04	$7.52	$11.56
207, Women's Room	D15	1.15		1	1	18	21	5	0	20	2	30	3	95.0%	0.0	5	$0.13	$0.24	$0.37
209, Office Area	A1	1.15		12	3	40	1,656	5	36	20	144	30	215	95.0%	1.6	395	$10.38	$19.34	$29.72
(Corridor)	A9	1.15		9	2	40	828	5	18	20	72	30	108	95.0%	0.8	197	$5.19	$9.67	$14.86
(Corridor)	D15	1.15		4	1	18	83	5	2	20	7	30	11	95.0%	0.1	20	$0.52	$0.97	$1.49
(Exit Sign)	E3	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
209A, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209B, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209C, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209D, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209E, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209F, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209H, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209I, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209J, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209K, Closet	A9	1.15		1	2	40	92	5	2	20	8	30	12	95.0%	0.1	22	$0.58	$1.07	$1.65
209L, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209M, Office	A1	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209N, Office	A1	1.15		3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43

Lighting Model For [illegible]ical Winter Month
Marshall Hall
Table 5.2.1

Room or Area Description	Luminaire Type (1)		Light Levels (FC)	No. Of Lum.	Lamps Per Luminaire	Watts Per Lamp	Total Watts	Off-Peak Time Period: hrs Per Week	Off-Peak Time Period: Off-Peak Kwh Per Month	Intermediate Time Period: hrs Per Week	Intermediate Time Period: Inter. Kwh Per Month	On-Peak Time Period: hrs Per Week	On-Peak Time Period: On-Peak Kwh Per Month	Percent Of Kw On-Peak	Demand Kw On-Peak	Total Kwh Per Month	Electric Costs: Monthly Demand (Kw)	Electric Costs: Monthly Usage (Kwh)	Electric Costs: Monthly Cost $
209O, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209P, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
209Q, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
210, Office	A1	1.15		8	3	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
(Passageway)	D	1		2	1	50	100	5	2	20	9	30	13	95.0%	0.1	24	$0.63	$1.17	$1.79
(Exit Sign)	E6	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
210A, Pick Up	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
210B, Office	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
210C, Office	A1	1.15		8	3	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
210D, Office	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
210E, Office	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
210F, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
210G, Office	A	1.15		1	4	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
210H, Office	A	1.15		6	4	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
210H, Office	A9	1.15		1	2	40	92	5	2	20	8	30	12	95.0%	0.1	22	$0.58	$1.07	$1.65
211, Security	A1	1.15		17	3	40	2,346	88	895	20	203	30	305	95.0%	2.2	1,403	$14.71	$58.62	$73.33
(Exit Sign)	E3	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
211A, Office	A1	1.15		6	3	40	828	5	18	20	72	30	108	95.0%	0.8	197	$5.19	$9.67	$14.86
211B, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
211C, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
211D, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
212, Office Area	A	1.15		10	4	40	1,840	5	40	20	159	30	239	95.0%	1.7	439	$11.54	$21.49	$33.02
212, Office Area	A9	1.15		4	2	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
(Passageway)	D	1		3	1	50	150	5	3	20	13	30	20	95.0%	0.1	36	$0.94	$1.75	$2.69
(Exit Sign)	E1	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
212A, Biofeedback	A	1.15		6	4	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
212B, Storage	A2	1.15		2	2	40	184	0	0	20	16	30	24	95.0%	0.2	40	$1.15	$2.00	$3.15
212C, Office	A	1.15		3	4	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
212D, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
212E, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
212F, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
212G, Office	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
212H, Office	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
212I, Office	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
213, Mechanical Room	A5	1.15		6	2	40	552	0	0	20	48	30	72	95.0%	0.5	120	$3.46	$6.00	$9.46
(Passageway)	D15	1.15		2	1	18	41	5	1	20	4	30	5	95.0%	0.0	10	$0.26	$0.48	$0.74
(Exit Sign)	E6	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
Lobby, Corridors, & Open Areas	A18	1.15		30	2	40	2,760	5	60	20	239	30	359	95.0%	2.6	658	$17.31	$32.23	$49.54
Lobby, Corridors, & Open Areas	F4	1.15		27	1	75	2,329	5	50	20	202	30	303	95.0%	2.2	555	$14.60	$27.20	$41.80
Lobby, Corridors, & Open Areas	B	1.15		16	2	13	478	5	10	20	41	30	62	95.0%	0.5	114	$3.00	$5.59	$8.59
Lobby, Corridors, & Open Areas	D15	1.15		14	1	18	290	5	6	20	25	30	38	95.0%	0.3	69	$1.82	$3.38	$5.20
Lobby, Corridors, & Open Areas	C2	1.15		7	8	13	837	5	18	20	73	30	109	95.0%	0.8	200	$5.25	$9.78	$15.03
Lobby, Corridors, & Open Areas	C	1.15		10	1	250	2,875	5	62	20	249	30	374	95.0%	2.7	685	$18.03	$33.58	$51.60
Lobby, Corridors, & Open Areas	A6	1.15		5	1	40	230	5	5	20	20	30	30	95.0%	0.2	55	$1.44	$2.69	$4.13
Lobby, Corridors, & Open Areas	D	1		36	1	50	1,800	5	39	20	156	30	234	95.0%	1.7	429	$11.29	$21.02	$32.31
(Exit Sign)	E1	1.15		4	2	8	74	88	28	40	13	40	13	95.0%	0.1	54	$0.46	$2.30	$2.76
Third Floor:																			
309, Office Area	A1	1.15		10	3	40	1,380	5	30	20	120	30	179	95.0%	1.3	329	$8.65	$16.12	$24.77
(Exit Sign)	E7	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
309A, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
309B, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
309B-1,	D15	1.15		1	1	18	21	5	0	20	2	30	3	95.0%	0.0	5	$0.13	$0.24	$0.37
309B-1,	A2	1.15		1	2	40	92	5	2	20	8	30	12	95.0%	0.1	22	$0.58	$1.07	$1.65
309C, Office	A	1.15		5	4	40	920	5	20	20	80	30	120	95.0%	0.9	219	$5.77	$10.74	$16.51
309D, Storage	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
309E, Passageway	A9	1.15		3	2	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
(Exit Sign)	E1	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
310, Men's Room	A11	1.15		4	2	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
310, Men's Room	D15	1.15		1	1	18	21	5	0	20	2	30	3	95.0%	0.0	5	$0.13	$0.24	$0.37
311, Women's Room	A11	1.15		4	2	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
311, Women's Room	D15	1.15		1	1	18	21	5	0	20	2	30	3	95.0%	0.0	5	$0.13	$0.24	$0.37
314, Office Area	A	1.15		26	4	40	4,784	5	104	20	415	30	622	95.0%	4.5	1,140	$30.00	$55.87	$85.86
314, Office Area	A9	1.15		9	2	40	828	5	18	20	72	30	108	95.0%	0.8	197	$5.19	$9.67	$14.86
314A, Study Room	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
314B, Study Room	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
314C, Study Room	A2	1.15		3	2	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
314D, Office	A1	1.15		3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
314E, Seminar	A	1.15		8	4	40	1,472	5	32	20	128	30	191	95.0%	1.4	351	$9.23	$17.19	$26.42

Lighting Model For Typical Winter Month
Marshall Hall
Table 5.2.1

Room or Area Description	Luminaire Type (1)		Light Levels (FC)	No. Of Lum.	Lamps Per Luminaire	Watts Per Lamp	Total Watts	Off-Peak Time Period: hrs Per Week	Off-Peak Time Period: Off-Peak Kwh Per Month	Intermediate Time Period: hrs Per Week	Intermediate Time Period: Inter. Kwh Per Month	On-Peak Time Period: hrs Per Week	On-Peak Time Period: On-Peak Kwh Per Month	Percent Of Kw On-Peak	Demand Kw On-Peak	Total Kwh Per Month	Electric Costs: Monthly Demand (Kw)	Electric Costs: Monthly Usage (Kwh)	Electric Costs: Monthly Cost $
314F, A.D.P. Room	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
314G, Study Room	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
314H, Study Room	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
314I, Study Room	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
314J, Study Room	A	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
314K, Study Room	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
314L, Office	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
314M, Office	A	1.15		3	4	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
314N, Office	A	1.15		3	4	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
314O, Office	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
314P, Electrical Closet	A1	1.15		1	3	40	138	0	0	2	1	2	1	5.0%	0.0	2	$0.05	$0.12	$0.16
314Q, Telephone Closet	A1	1.15		1	3	40	138	0	0	2	1	2	1	5.0%	0.0	2	$0.05	$0.12	$0.16
314R, Office	A	1.15		1	4	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
314S, Office	A	1.15		1	4	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
314U, Study Room	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
314V, Study Room	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
315, Mechanical Room	A5	1.15		6	2	40	552	0	0	20	48	30	72	95.0%	0.5	120	$3.46	$6.00	$9.46
311A, Closet	A3	1.15		2	2	40	184	0	0	2	2	2	2	10.0%	0.0	3	$0.12	$0.16	$0.28
Open Areas & Corridors	A18	1.15		43	2	40	3,956	5	86	20	343	30	514	95.0%	3.8	943	$24.80	$46.20	$71.00
Open Areas & Corridors	B	1.15		37	2	13	1,106	5	24	20	96	30	144	95.0%	1.1	264	$6.94	$12.92	$19.86
Open Areas & Corridors	D15	1.15		14	1	18	290	5	6	20	25	30	38	95.0%	0.3	69	$1.82	$3.38	$5.20
Open Areas & Corridors	F4	1.15		12	1	75	1,035	5	22	20	90	30	135	95.0%	1.0	247	$6.49	$12.09	$18.58
Open Areas & Corridors	C2	1.15		9	8	13	1,076	5	23	20	93	30	140	95.0%	1.0	257	$6.75	$12.57	$19.32
Open Areas & Corridors	C3	1.15		9	1	250	2,588	5	56	20	224	30	336	95.0%	2.5	617	$16.22	$30.22	$46.44
Open Areas & Corridors	A6	1.15		5	1	40	230	5	5	20	20	30	30	95.0%	0.2	55	$1.44	$2.69	$4.13
Open Areas & Corridors	D1	1		31	1	50	1,550	5	34	20	134	30	202	95.0%	1.5	369	$9.72	$18.10	$27.82
(Exit Sign)	E7	1.15		10	2	8	184	88	70	40	32	40	32	95.0%	0.2	134	$1.15	$5.75	$6.91
Clerestory	A24	1.15		166	2	48	18,326	5	397	20	1,588	30	2,382	95.0%	17.4	4,368	$114.91	$214.02	$328.93
Clerestory	A5	1.15		15	2	40	1,380	5	30	20	120	30	179	95.0%	1.3	329	$8.65	$16.12	$24.77
Sub-totals							**118,552**		**3,543**		**10,221**		**15,278**		**111.5**	**29,043**	**$735.68**	**$1,411.02**	**$2,146.70**
AHU-6																			
Second Floor:																			
214, Library	A17	1.15	30	619	2	40	56,948	5	1,234	20	4,935	30	7,403	95.0%	54.1	13,573	$357.06	$665.06	$1,022.12
214, Library	A6	1.15		101	1	40	4,646	5	101	20	403	30	604	95.0%	4.4	1,107	$29.13	$54.26	$83.39
214, Library	D15	1.15		97	1	18	2,008	5	44	20	174	30	261	95.0%	1.9	479	$12.59	$23.45	$36.04
214, Library	C	1.15		10	2	250	5,750	5	125	20	498	30	748	95.0%	5.5	1,370	$36.05	$67.15	$103.20
214, Library	D1	1.15		42	1	50	2,415	5	52	20	209	30	314	95.0%	2.3	576	$15.14	$28.20	$43.35
(Exit Sign)	E	1.15		6	2	8	110	88	42	40	19	40	19	95.0%	0.1	80	$0.69	$3.45	$4.14
215, Study Room	A1	1.15		2	3	40	276	0	0	20	24	30	36	95.0%	0.3	60	$1.73	$3.00	$4.73
216, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
217, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
218, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
219, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
220, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
221, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
222, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
223, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
224, Men's Room	A11	1.15		4	2	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
224, Men's Room	D15	1.15		1	1	18	21	5	0	20	2	30	3	95.0%	0.0	5	$0.13	$0.24	$0.37
225, Electrical Closet	A5	1.15		3	2	40	276	5	0	2	2	2	2	5.0%	0.0	5	$0.09	$0.24	$0.33
226, Copy Room	A3	1.15		1	2	40	92	5	2	20	8	30	12	95.0%	0.1	22	$0.58	$1.07	$1.65
227, Women's Room	A11	1.15		4	2	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
227, Women's Room	D15	1.15		1	1	18	21	5	0	20	2	30	3	95.0%	0.0	5	$0.13	$0.24	$0.37
228 Closet	A5	1.15		1	2	40	92	0	0	2	1	2	1	10.0%	0.0	2	$0.06	$0.08	$0.14
229, Corridor	D15	1.15		5	1	18	104	5	2	20	9	30	13	95.0%	0.1	25	$0.65	$1.21	$1.86
230, Mechanical	A5	1.15	30	9	2	40	828	0	0	20	72	30	108	95.0%	0.8	179	$5.19	$9.01	$14.20
231, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
232, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
233, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
234, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
235, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
236, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
237, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
238, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
239, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
240, Study Room	A1	1.15		1	3	40	138	0	0	20	12	30	18	95.0%	0.1	30	$0.87	$1.50	$2.37
241, Storage	A5	1.15		2	2	40	184	0	0	20	16	30	24	95.0%	0.2	40	$1.15	$2.00	$3.15
248, Sorting Room	A1	1.15		2	3	40	276	0	0	20	24	30	36	95.0%	0.3	60	$1.73	$3.00	$4.73

Lighting Model For Typical Winter Month
Marshall Hall
Table 5.2.1

Room or Area Description	Luminaire Type (1)		Light Levels (FC)	No. Of Lum.	Lamps Per Luminaire	Watts Per Lamp	Total Watts	Off-Peak Time Period: hrs Per Week	Off-Peak Time Period: Off-Peak Kwh Per Month	Intermediate Time Period: hrs Per Week	Intermediate Time Period: Inter. Kwh Per Month	On-Peak Time Period: hrs Per Week	On-Peak Time Period: On-Peak Kwh Per Month	Percent Of Kw On-Peak	Demand Kw On-Peak	Total Kwh Per Month	Electric Costs: Monthly Demand (Kw)	Electric Costs: Monthly Usage (Kwh)	Electric Costs: Monthly Cost $
Third Floor:																			
316, Vestibule	D15	1.15		2	1	18	41	5	1	20	4	30	5	95.0%	0.0	10	$0.26	$0.48	$0.74
316A, Office Area	A	1.15		11	4	40	2,024	5	44	20	175	30	263	95.0%	1.9	482	$12.69	$23.64	$36.33
(Exit Sign)	E1	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
316B, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
316C, Processing	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
316D, Vault	A17	1.15		18	2	40	1,656	0	0	20	144	30	215	95.0%	1.6	359	$10.38	$18.01	$28.39
316E, Reading Room	A	1.15		6	4	40	1,104	0	0	20	96	30	144	95.0%	1.0	239	$6.92	$12.01	$18.93
316E-1, Corridor	D15	1.15		1	1	18	21	5	0	20	2	30	3	95.0%	0.0	5	$0.13	$0.24	$0.37
316E-2, Corridor	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
(Exit Sign)	E6	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
316F, Reading Room	A	1.15		16	4	40	2,944	0	0	20	255	30	383	95.0%	2.8	638	$18.46	$32.02	$50.48
316G, Reading Room	A	1.15		9	4	40	1,656	0	0	20	144	30	215	95.0%	1.6	359	$10.38	$18.01	$28.39
319, Special Collections & History	A20	1.15		38	1	40	1,748	5	38	20	151	30	227	95.0%	1.7	417	$10.96	$20.41	$31.37
319, Special Collections & History	D15	1.15		8	1	18	166	5	4	20	14	30	22	95.0%	0.2	39	$1.04	$1.93	$2.97
319A, Office Area	A2	1.15	35	4	2	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
319B, Conserv. Lab	A21	1.15	75	6	4	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
319E, Office	A21	1.15		2	4	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
320, Staff Room	A	1.15		4	4	40	736	0	0	20	64	30	96	95.0%	0.7	159	$4.61	$8.01	$12.62
321, Janitor's Closet	A5	1.15		1	2	40	92	0	0	2	1	2	1	5.0%	0.0	2	$0.03	$0.08	$0.11
322, Telephone Closet	A5	1.15		1	2	40	92	0	0	2	1	2	1	5.0%	0.0	2	$0.03	$0.08	$0.11
323, Electric Closet	A5	1.15		1	2	40	92	0	0	2	1	2	1	5.0%	0.0	2	$0.03	$0.08	$0.11
324, Secure Room	A	1.15	30	4	4	40	736	0	0	20	64	30	96	95.0%	0.7	159	$4.61	$8.01	$12.62
325, Mail	A	1.15		3	4	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
326, Office Area	A	1.15	50	22	4	40	4,048	5	88	20	351	30	526	95.0%	3.8	965	$25.38	$47.27	$72.65
(Exit Sign)	E6	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
326A, Secure Storage	A5	1.15		1	2	40	92	0	0	20	8	30	12	95.0%	0.1	20	$0.58	$1.00	$1.58
326B, Office	A	1.15		1	4	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
326C, Office	A2	1.15		1	4	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
327, Supply Room	A5	1.15		5	2	40	460	0	0	2	4	2	4	10.0%	0.0	8	$0.30	$0.39	$0.70
327A, Mechanical Room	A5	1.15		4	2	40	368	0	0	20	32	30	48	95.0%	0.3	80	$2.31	$4.00	$6.31
328, Men's Room	A11	1.15		4	2	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
328, Men's Room	D15	1.15		1	1	18	21	5	0	20	2	30	3	95.0%	0.0	5	$0.13	$0.24	$0.37
329, Women's Room	A6	1.15		4	1	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
329, Women's Room	D15	1.15		2	1	18	41	5	1	20	4	30	5	95.0%	0.0	10	$0.26	$0.48	$0.74
330, Corridor	A2	1.15		4	2	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
(Exit Sign)	E1	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
Sub-totals							**100,464**		**1,937**		**8,638**		**12,935**		**94.5**	**23,510**	**$623.53**	**$1,154.58**	**$1,778.11**
AHU-7																			
Ground Floor:																			
154, Kitchen	A19	1.15	40	23	4	40	4,232	10	183	20	367	30	550	95.0%	4.0	1,100	$26.53	$52.82	$79.35
154A, Office	A2	1.15		2	2	40	184	10	8	20	16	30	24	95.0%	0.2	48	$1.15	$2.30	$3.45
154B, Office	A2	1.15		2	2	40	184	10	8	20	16	30	24	95.0%	0.2	48	$1.15	$2.30	$3.45
154D, Walk-in Cooler		1		1	1	90	90	10	4	2	1	2	1	5.0%	0.0	5	$0.03	$0.22	$0.25
154E, Walk-in Cooler		1		1	1	90	90	10	4	2	1	2	1	5.0%	0.0	5	$0.03	$0.22	$0.25
154F, Cafeteria	A6	1.15	50	144	1	40	6,624	10	287	20	574	30	861	95.0%	6.3	1,722	$41.53	$82.67	$124.20
154G, Serving Area	D2	1		33	1	50	1,650	10	72	20	143	30	215	95.0%	1.6	429	$10.35	$20.59	$30.94
Sub-totals							**13,054**		**566**		**1,117**		**1,675**		**12.2**	**3,358**	**$80.78**	**$161.11**	**$241.89**
AHU-8																			
Ground Floor:																			
100, Mechanical Room	A5	1.15		6	2	40	552	0	0	20	48	30	72	95.0%	0.5	120	$3.46	$6.00	$9.46
(Passageway)	A5	1.15		2	2	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
(Passageway)	D15	1.15		2	1	18	41	5	1	20	4	30	5	95.0%	0.0	10	$0.26	$0.48	$0.74
(Exit Sign)	E6	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
101, Classroom	A15	1.15	25	11	2	40	1,012	5	22	20	88	30	132	95.0%	1.0	241	$6.35	$11.82	$18.16
102, Classroom	A15	1.15	25	11	2	40	1,012	5	22	20	88	30	132	95.0%	1.0	241	$6.35	$11.82	$18.16
103, Seminar	A15	1.15	20	24	2	40	2,208	5	48	20	191	30	287	95.0%	2.1	526	$13.84	$25.79	$39.63
104, Seminar	A15	1.15		26	2	40	2,392	5	52	20	207	30	311	95.0%	2.3	570	$15.00	$27.93	$42.93
105, Seminar	A15	1.15	40	20	2	40	1,840	5	40	20	159	30	239	95.0%	1.7	439	$11.54	$21.49	$33.02
106, Classroom	A15	1.15		24	2	40	2,208	5	48	20	191	30	287	95.0%	2.1	526	$13.84	$25.79	$39.63
107, Office	A1	1.15		3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
108, Office	A1	1.15		3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
109, Corridor	A9	1.15		13	2	40	1,196	5	26	20	104	30	155	95.0%	1.1	285	$7.50	$13.97	$21.47
109, Corridor	D3	1		10	1	25	250	5	5	20	22	30	33	95.0%	0.2	60	$1.57	$2.92	$4.49
109, Corridor	D15	1.15		4	1	18	83	5	2	20	7	30	11	95.0%	0.1	20	$0.52	$0.97	$1.49
(Exit Sign)	E1	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
(Electrical Closet)	A5	1.15		2	2	40	184	0	0	2	2	2	2	5.0%	0.0	3	$0.06	$0.16	$0.22
110, Classroom	A15	1.15	25	10	2	40	920	5	20	20	80	30	120	95.0%	0.9	219	$5.77	$10.74	$16.51

Lighting Model For Typical Winter Month
Marshall Hall
Table 5.2.1

Room or Area Description	Luminaire Type (1)		Light Levels (FC)	No. Of Lum.	Lamps Per Luminaire	Watts Per Lamp	Total Watts	Off-Peak Time Period: hrs Per Week	Off-Peak Time Period: Off-Peak Kwh Per Month	Intermediate Time Period: hrs Per Week	Intermediate Time Period: Inter. Kwh Per Month	On-Peak Time Period: hrs Per Week	On-Peak Time Period: On-Peak Kwh Per Month	Percent Of Kw On-Peak	Demand Kw On-Peak	Total Kwh Per Month	Electric Costs: Monthly Demand (Kw)	Electric Costs: Monthly Usage (Kwh)	Electric Costs: Monthly Cost $
111, Classroom	A15	1.15	25	10	2	40	920	5	20	20	80	30	120	95.0%	0.9	219	$5.77	$10.74	$16.51
112, Telephone Room	A5	1.15		2	2	40	184	0	0	2	2	2	2	5.0%	0.0	3	$0.06	$0.16	$0.22
113, Security Desk	A9	1.15		2	4	40	368	88	140	40	64	40	64	95.0%	0.3	268	$2.31	$11.51	$13.81
Second Floor:																			
200, Mechanical Room	A5	1.15	30	6	2	40	552	0	0	20	48	30	72	95.0%	0.5	120	$3.46	$6.00	$9.46
201, Rec./Work	A	1.15	40	24	4	40	4,416	5	96	20	383	30	574	95.0%	4.2	1,052	$27.69	$51.57	$79.26
(Exit Sign)	E6	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
201A, Office	A1	1.15		4	3	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
201B, Office	A1	1.15		4	3	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
201C, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
201D, Office	A	1.15		1	4	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
201E, Office	A	1.15		1	4	40	184	5	4	20	16	30	24	95.0%	0.2	44	$1.15	$2.15	$3.30
201F, Conference	A	1.15	35	4	4	40	736	0	0	20	64	30	96	95.0%	0.7	159	$4.61	$8.01	$12.62
201G, Office	A1	1.15		3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
201H, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
201I, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
202, Office	A1	1.15		6	3	40	828	5	18	20	72	30	108	95.0%	0.8	197	$5.19	$9.67	$14.86
202A, Passageway	D1	1		3	1	50	150	5	3	20	13	30	20	95.0%	0.1	36	$0.94	$1.75	$2.69
203, Office Area	A1	1.15	40	24	3	40	3,312	5	72	20	287	30	431	95.0%	3.1	789	$20.77	$38.68	$59.44
(Exit Sign)	E6	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
203A, Conference	A1	1.15		4	3	40	552	0	0	10	24	10	24	50.0%	0.3	48	$1.82	$2.37	$4.19
203B, Office	A1	1.15		4	3	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
203C, Office	A1	1.15		4	3	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
203D, Office	A1	1.15		4	3	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
204, Electrical Closet	A5	1.15		2	2	40	184	0	0	2	2	2	2	5.0%	0.0	3	$0.06	$0.16	$0.22
204A, Telephone Closet	A5	1.15		2	2	40	184	0	0	2	2	2	2	5.0%	0.0	3	$0.06	$0.16	$0.22
Third Floor:																			
300, Mechanical Room	A5	1.15		6	2	40	552	0	0	20	48	30	72	95.0%	0.5	120	$3.46	$6.00	$9.46
301, Office Area	A	1.15		6	4	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
(Exit Sign)	E6	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
301A, Office	A1	1.15		4	3	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
301B, Office	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
301C, Storage	A	1.15		2	4	40	368	0	0	20	32	30	48	95.0%	0.3	80	$2.31	$4.00	$6.31
302, Conference Room	A1	1.15		6	3	40	828	0	0	10	36	10	36	50.0%	0.4	72	$2.73	$3.55	$6.28
303, Conference Room	A1	1.15		6	3	40	828	0	0	10	36	10	36	50.0%	0.4	72	$2.73	$3.55	$6.28
305, Corridor & Copy Area	A9	1.15		12	2	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
305, Corridor & Copy Area	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
305A, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
305B, Office	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
305C, Office	A1	1.15		3	3	40	414	5	9	20	36	30	54	95.0%	0.4	99	$2.60	$4.83	$7.43
306, Operations	A1	1.15		8	3	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
306A, Office	A1	1.15		4	3	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
306B, Office	A1	1.15		4	3	40	552	5	12	20	48	30	72	95.0%	0.5	132	$3.46	$6.45	$9.91
306C	A23	1.15		1	2	40	92	5	2	20	8	30	12	95.0%	0.1	22	$0.58	$1.07	$1.65
307, Office Area	A	1.15		11	4	40	2,024	5	44	20	175	30	263	95.0%	1.9	482	$12.69	$23.64	$36.33
(Exit Sign)	E1	1.15		2	2	8	37	88	14	40	6	40	6	95.0%	0.0	27	$0.23	$1.15	$1.38
307A, Office	A	1.15		6	4	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
307A, Office	A11	1.15		1	2	40	92	5	2	20	8	30	12	95.0%	0.1	22	$0.58	$1.07	$1.65
307B, Office	A1	1.15		2	3	40	276	5	6	20	24	30	36	95.0%	0.3	66	$1.73	$3.22	$4.95
307C, Closet	A1	1.15		4	3	40	552	0	0	20	48	30	72	95.0%	0.5	120	$3.46	$6.00	$9.46
307D, Passageway	D15	1.15		5	1	18	104	0	0	20	9	30	13	95.0%	0.1	22	$0.65	$1.13	$1.77
308, Ceremonial Room	A8	1.15		30	1	20	690	0	0	20	60	30	90	95.0%	0.7	150	$4.33	$7.50	$11.83
308, Ceremonial Room	A3	1.15		5	2	40	460	0	0	20	40	30	60	95.0%	0.4	100	$2.88	$5.00	$7.89
308, Ceremonial Room	D15	1.15		3	1	18	62	0	0	20	5	30	8	95.0%	0.1	13	$0.39	$0.68	$1.06
308, Ceremonial Room	H1	1.15		2	3	40	276	0	0	20	24	30	36	95.0%	0.3	60	$1.73	$3.00	$4.73
308, Ceremonial Room	D	1		27	1	50	1,350	0	0	20	117	30	176	95.0%	1.3	293	$8.46	$14.68	$23.15
308, Ceremonial Room	D8	1		12	1	100	1,200	0	0	20	104	30	156	95.0%	1.1	260	$7.52	$13.05	$20.58
Sub-totals							**50,519**		**1,048**		**4,268**		**6,308**		**46.3**	**11,625**	**$305.82**	**$569.45**	**$875.28**
AC-2																			
Ground Floor:																			
169B, Office	A1	1.15		1	3	40	138	5	3	20	12	30	18	95.0%	0.1	33	$0.87	$1.61	$2.48
169C, Fire Pump Room	A5	1.15		2	2	40	184	0	0	2	2	2	2	5.0%	0.0	3	$0.06	$0.16	$0.22
Sub-totals							**322**		**3**		**14**		**20**		**0.1**	**36**	**$0.93**	**$1.77**	**$2.70**
AC-3																			
Third Floor:																			
333C, Computer Room	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
AC-4																			
Ground Floor:																			

Lighting Model For Typical Winter Month
Marshall Hall
Table 5.2.1

Room or Area Description	Luminaire Type (1)		Light Levels (FC)	No. Of Lum.	Lamps Per Luminaire	Watts Per Lamp	Total Watts	Off-Peak Time Period: hrs Per Week	Off-Peak Time Period: Off-Peak Kwh Per Month	Intermediate Time Period: hrs Per Week	Intermediate Time Period: Inter. Kwh Per Month	On-Peak Time Period: hrs Per Week	On-Peak Time Period: On-Peak Kwh Per Month	Percent Of Kw On-Peak	Demand Kw On-Peak	Total Kwh Per Month	Electric Costs: Monthly Demand (Kw)	Electric Costs: Monthly Usage (Kwh)	Electric Costs: Monthly Cost $
152A, Computer Room	A	1.15	50	10	4	40	1,840	5	40	20	159	30	239	95.0%	1.7	439	$11.54	$21.49	$33.02
FC-1																			
Third Floor:																			
313C, Seminar	A9	1.15		20	2	40	1,840	5	40	20	159	30	239	95.0%	1.7	439	$11.54	$21.49	$33.02
313C, Seminar	D9	1		16	1	100	1,600	5	35	20	139	30	208	95.0%	1.5	381	$10.03	$18.69	$28.72
Sub-totals							3,440		75		298		447		3.3	820	$21.57	$40.17	$61.74
FC-2																			
Third Floor:																			
313B, Office	A	1.15		6	4	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
(Passageway)	A9	1.15		4	2	40	368	5	8	20	32	30	48	95.0%	0.3	88	$2.31	$4.30	$6.60
Sub-totals							1,472		32		128		191		1.4	351	$9.23	$17.19	$26.42
FC-3																			
Third Floor:																			
313, Reception	A	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
313, Reception	A9	1.15		1	2	40	92	5	2	20	8	30	12	95.0%	0.1	22	$0.58	$1.07	$1.65
Sub-totals							828		18		72		108		0.8	197	$5.19	$9.67	$14.86
FC-4																			
Third Floor:																			
313A, Office	A	1.15		6	4	40	1,104	5	24	20	96	30	144	95.0%	1.0	263	$6.92	$12.89	$19.81
FC-5																			
Ground Floor:																			
MISC.																			
Ground Floor:																			
192, Security	A1	1.15		2	3	40	276	88	105	40	48	40	48	95.0%	0.3	201	$1.73	$8.63	$10.36
192, Security	A5	1.15		1	2	40	92	88	35	40	16	40	16	95.0%	0.1	67	$0.58	$2.88	$3.45
167, Electrical Room	A5	1.15		4	2	40	368	0	0	2	3	2	3	5.0%	0.0	6	$0.12	$0.32	$0.44
167A, Transformers	A5	1.15		4	2	40	368	0	0	2	3	2	3	5.0%	0.0	6	$0.12	$0.32	$0.44
167B, Generator Room	A5	1.15		4	2	40	368	0	0	2	3	2	3	5.0%	0.0	6	$0.12	$0.32	$0.44
168, Corridor	A2	1.15		16	2	40	1,472	5	32	20	128	30	191	95.0%	1.4	351	$9.23	$17.19	$26.42
(Exit Sign)	E6	1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
(Janitor's Closet)	D9	1		1	1	100	100	0	0	2	1	2	1	5.0%	0.0	2	$0.03	$0.09	$0.12
169, Mechanical Room	A5	1.15	25	16	2	40	1,472	0	0	20	128	30	191	95.0%	1.4	319	$9.23	$16.01	$25.24
169A, Boiler Room	A5	1.15	20	9	2	40	828	0	0	20	72	30	108	95.0%	0.8	179	$5.19	$9.01	$14.20
Third Floor:																			
319C, Secure Vault	A21	1.15		4	4	40	736	0	0	2	6	2	6	5.0%	0.0	13	$0.24	$0.63	$0.87
319D, Vault/Stacks	A2	1.15	85	43	2	40	3,956	0	0	20	343	30	514	95.0%	3.8	857	$24.80	$43.03	$67.83
333C, Computer Room	A21	1.15		4	4	40	736	5	16	20	64	30	96	95.0%	0.7	175	$4.61	$8.60	$13.21
Penthouse:																			
Mech/Elec. Room	A5	1.15		15	2	40	1,380	0	0	20	120	30	179	95.0%	1.3	299	$8.65	$15.01	$23.66
Stairwells:																			
Stairwell #1	A14	1.15		3	2	40	276	88	105	40	48	40	48	95.0%	0.3	201	$1.73	$8.63	$10.36
Stairwell #1	B	1.15		3	2	13	90	88	34	40	16	40	16	95.0%	0.1	65	$0.56	$2.80	$3.37
(Exit Sign)		1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
Stairwell #2	A14	1.15		7	2	40	644	88	246	40	112	40	112	95.0%	0.6	469	$4.04	$20.14	$24.18
(Exit Sign)		1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
Stairwell #3	A14	1.15		6	2	40	552	88	210	40	96	40	96	95.0%	0.5	402	$3.46	$17.26	$20.72
(Exit Sign)		1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
Stairwell #4	A14	1.15		6	2	40	552	88	210	40	96	40	96	95.0%	0.5	402	$3.46	$17.26	$20.72
(Exit Sign)		1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
Stairwell #5	A14	1.15		3	2	40	276	88	105	40	48	40	48	95.0%	0.3	201	$1.73	$8.63	$10.36
Stairwell #5	B	1.15		3	2	13	90	88	34	40	16	40	16	95.0%	0.1	65	$0.56	$2.80	$3.37
(Exit Sign)		1.15		1	2	8	18	88	7	40	3	40	3	95.0%	0.0	13	$0.12	$0.58	$0.69
Sub-totals							14,742		1,176		1,383		1,809		12.3	4,368	$80.91	$202.99	$283.90
	TOTALS			4,789			470,603		12,793		40,836		60,179		437.2	113,808	$2,886	$5,541	$8,427

Winter Incremental Demand Cost $/Kw =	$6.60
Off-Peak Incremental Usage Cost $/Kwh =	$0.037
Intermediate Incremental Usage Cost $/Kwh	$0.046
On-Peak Incremental Usage Cost $/Kwh =	$0.053

NOTE #1: FOR BALLASTED LUMINAIRE A BALLAST FACTOR OF 1.15 IS USED, INCANDESCENT LUMINAIRE USE 1.

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25-Aug-95

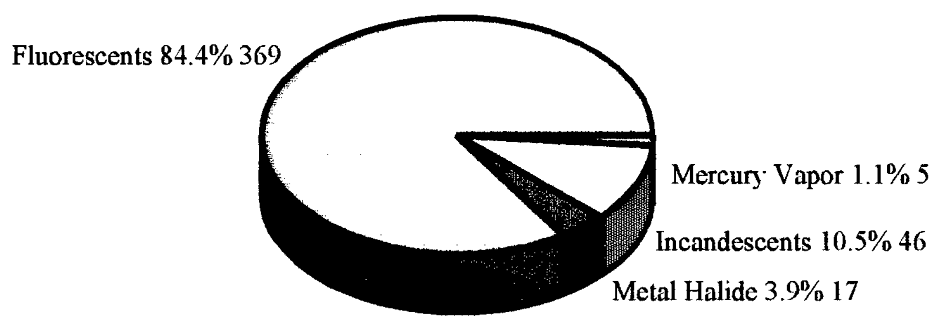
Table 5.2.2, Light Model Summary-Typical Monthly Distribution

Type	*# of Lum.*	*Demand*	*Usage*	*Cost $*
4' Fluorescent	3,372	345	88,366	$6,606
3' Fluorescent	384	13	2,870	$227
2' Fluorescent	30	1	150	$12
Mercury Vapor	63	5	1,263	$95
Compact FL	318	8	2,121	$157
Exit Signs	105	2	1,406	$73
Metal Halide	57	17	6,778	$413
Incandescent	460	46	10,854	$844
Totals	4,789	437	113,808	$8,427

Figure 5.2.3 below graphically displays lighting demand distribution for Marshall Hall.

Figure 5.2.3, Lighting Model Results

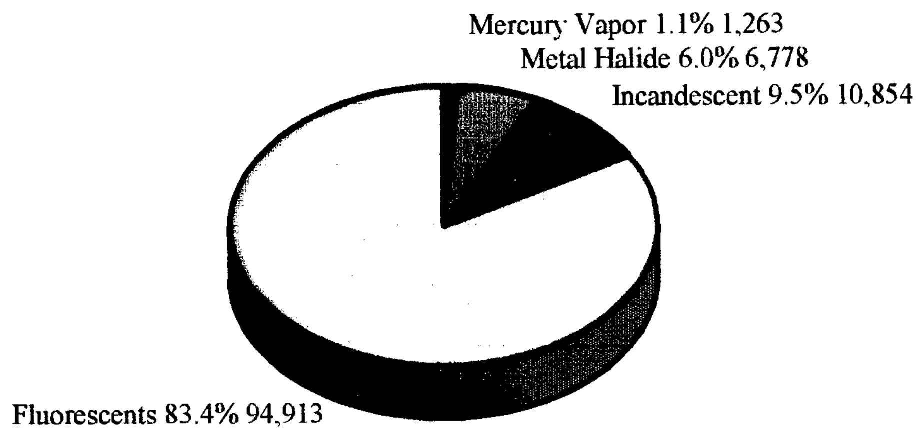
Typical Monthly Demand Distribution



The above graph indicates 84% of monthly lighting demand is from fluorescent luminaires of various types. Figure 5.2.4 below shows fluorescent luminaires contribute 83% of monthly lighting electric usage.

Figure 5.2.4, Lighting Model Results

Typical Monthly Usage Distribution



5.3 Electrical Model

An electric model, as described in Section 2.5.4, has been developed for Marshall Hall and can be viewed in Table 5.3.1 on the following pages. The model represents the 1993-94 operation of the building as indicated by Ft. McNair personnel and observed by Entech teams. The model is employed to approximate the contribution from electrical users to the buildings annual electric cost. The electric model will be used in conjunction with other models during subsequent calculations to determine future energy costs and savings. Table 5.3.2 summarizes the results of the electric model.

No.	Description	Total Connecte Load (k	Winter Demand kW/Month	Inter Demand kW/Month	Summer Demand kW/Month	Winter Billing Months						Intermediate Billing			
						Off-Peak		Inter.		On-Peak		Off-Peak		Inter.	
						hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/M
1															
2	**AHU-1N**														
3	*Ground Floor:*														
4	Cabinet Unit Heater 1-B	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	
5	Cabinet Unit Heater 2-B	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	
6	Cabinet Unit Heater 3-N	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	
7	**AHU-1S**														
8	*Ground Floor:*														
9	Cabinet Unit Heater 1-E	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	
10	Cabinet Unit Heater 3-S	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	
11	Lighting	5.4	5.1	5.1	5.1		149		472		700		149		4
12	Miscellaneous Equip	5.0	2.0	2.0	2.0	5.0	750	2.0	200	2.0	200	5.0	750	2.0	2
13	**Sub-totals**	**11.0**	**7.6**	**7.1**	**7.1**		**1,070**		**738**		**966**		**899**		6
14	**AHU-2**														
15	*Roof:*														
16	Exhaust Fan 2-E	0.4	0.3	0.3	0.3	9.5	114	5.5	44	5.5	44	9.5	114	5.5	4
17	Exhaust Fan 2-F	0.4	0.3	0.3	0.3	9.5	114	5.5	44	5.5	44	9.5	114	5.5	4
18	Exhaust Fan 22	0.1	0.1	0.1	0.1	9.5	34	5.5	13	5.5	13	9.5	34	5.5	1
19	Lighting	64.2	60.1	60.1	60.1		3,578		6,017		8,489		3,578		6,0
20	Miscellaneous Equip	31.0	12.4	12.4	12.4	5.0	4,650	2.0	1,240	2.0	1,240	5.0	4,650	2.0	1,2
21	**Sub-totals**	**96.1**	**73.2**	**73.2**	**73.2**		**8,490**		**7,358**		**9,830**		**8,490**		7,35
22	**AHU-3**														
23	*Ground Floor:*														
24	Fan Coil Unit 5	0.4	0.3	0.3	0.3	9.5	103	5.5	40	5.5	40	9.5	103	5.5	4
25	*Third Floor:*														
26	AC Unit 3	0.8	0.6	0.6	0.6	9.5	214	5.5	83	5.5	83	9.5	214	5.5	8
27	*Roof:*														
28	Exhaust Fan 18	0.2	0.1	0.1	0.1	9.5	54	5.5	21	5.5	21	9.5	54	5.5	2
29	Exhaust Fan 3-B	0.3	0.2	0.2	0.2	9.5	71	5.5	28	5.5	28	9.5	71	5.5	2
30	Lighting	65.2	58.8	58.8	58.8		533		5,384		7,995		533		5,38
31	Miscellaneous Equip	23.0	9.2	9.2	9.2	5.0	3,450	2.0	920	2.0	920	5.0	3,450	2.0	92
32	**Sub-totals**	**89.8**	**69.2**	**69.2**	**69.2**		**4,425**		**6,475**		**9,086**		**4,425**		**6,475**
33	**AHU-4**														
34	Lighting	28.8	27.3	27.3	27.3		56		2,505		3,745		56		2,505
35	Miscellaneous Equip	5.0	2.0	2.0	2.0	5.0	750	2.0	200	2.0	200	5.0	750	2.0	200
36	**Sub-totals**	**33.8**	**29.3**	**29.3**	**29.3**		**806**		**2,705**		**3,945**		**806**		**2,705**
37	**AHU-5**														
38	*Ground Floor:*														
39	Air Handler 1S	7.5	5.6	5.6	5.6	9.5	2,138	5.5	825	5.5	825	9.5	2,138	5.5	825
40	Fan Coil Unit 1	0.8	0.6	0.6	0.6	9.5	214	5.5	83	5.5	83	9.5	214	5.5	83
41	Fan Coil Unit 2	0.6	0.5	0.5	0.5	9.5	171	5.5	66	5.5	66	9.5	171	5.5	66
42	Fan Coil Unit 3	0.5	0.4	0.4	0.4	9.5	143	5.5	55	5.5	55	9.5	143	5.5	55
43	Fan Coil Unit 4	0.5	0.4	0.4	0.4	9.5	143	5.5	55	5.5	55	9.5	143	5.5	55
44	AC Unit 1	1.1	0.8	0.8	0.8	9.5	314	5.5	121	5.5	121	9.5	314	5.5	121
45	*Second Floor:*														
46	Air Handler 5	22.4	16.8	16.8	16.8	9.5	6,384	5.5	2,464	5.5	2,464	9.5	6,384	5.5	2,464
47	*Third Floor:*														
48	Return Air Fan 1S	3.7	2.8	2.8	2.8	9.5	1,055	5.5	407	5.5	407	9.5	1,055	5.5	407
49	Return Air Fan 5	11.2	8.4	8.4	8.4	9.5	3,192	5.5	1,232	5.5	1,232	9.5	3,192	5.5	1,232
50	Exhaust Fan 5A	0.8	0.6	0.6	0.6	9.5	214	5.5	83	5.5	83	9.5	214	5.5	83
51	Exhaust Fan 5B	0.3	0.2	0.2	0.2	9.5	71	5.5	28	5.5	28	9.5	71	5.5	28
52	Lighting	118.6	111.5	111.5	111.5		3,543		10,221		15,278		3,543		10,221
53	Miscellaneous Equip	44.0	17.6	17.6	17.6	5.0	6,600	2.0	1,760	2.0	1,760	5.0	6,600	2.0	1,760
54	**Sub-totals**	**211.9**	**166.0**	**166.0**	**166.0**		**24,179**		**17,399**		**22,456**		**24,179**		**17,399**
55	**AHU-6**														
56	*Second Floor:*														
57	Air Handler 6	56.0	42.0	42.0	42.0	8.5	14,280	4.5	5,040	4.5	5,040	8.5	14,280	4.5	5,040
58	Return Air Fan 6	22.4	16.8	16.8	16.8	8.5	5,712	4.5	2,016	4.5	2,016	8.5	5,712	4.5	2,016
59	Unit Heater 4	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	0
60	Transfer Fan 3C	0.8	0.6	0.6	0.6	9.5	214	5.5	83	5.5	83	9.5	214	5.5	83
61	Cabinet Unit Heater 3E	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	0
62	*Third Floor:*														
63	Exhaust Fan 2A	0.4	0.3	0.3	0.3	9.5	105	5.5	41	5.5	41	9.5	105	5.5	41
64	Exhaust Fan 2B	0.6	0.4	0.4	0.4	9.5	160	5.5	62	5.5	62	9.5	160	5.5	62
65	Exhaust Fan 6B	0.1	0.1	0.1	0.1	9.5	34	5.5	13	5.5	13	9.5	34	5.5	13
66	Exhaust Fan 6A	0.3	0.2	0.2	0.2	9.5	71	5.5	28	5.5	28	9.5	71	5.5	28
67	Exhaust Fan 19	0.1	0.1	0.1	0.1	9.5	34	5.5	13	5.5	13	9.5	34	5.5	13
68	Exhaust Fan 20	0.2	0.1	0.1	0.1	9.5	54	5.5	21	5.5	21	9.5	54	5.5	21
69	Exhaust Fan 2C	0.1	0.1	0.1	0.1	9.5	34	5.5	13	5.5	13	9.5	34	5.5	13
70	Exhaust Fan 2D	0.2	0.2	0.2	0.2	9.5	57	5.5	22	5.5	22	9.5	57	5.5	22
71	Exhaust Fan 6C	0.1	0.1	0.1	0.1	9.5	34	5.5	13	5.5	13	9.5	34	5.5	13
72	Lighting	100.5	94.5	94.5	94.5		1,937		8,638		12,935		1,937		8,638
73	Miscellaneous Equip	26.0	10.4	10.4	10.4	5.0	3,900	2.0	1,040	2.0	1,040	5.0	3,900	2.0	1,040
74	**Sub-totals**	**207.9**	**166.0**	**165.8**	**165.8**		**26,695**		**17,068**		**21,365**		**26,627**		**17,042**
75	**AHU-7**														
76	*Ground Floor:*														
77	Convection Oven	0.3	0.1	0.1	0.1	2.0	15	2.0	10	2.0	10	2.0	15	2.0	10
78	Chilled Water	0.2	0.1	0.1	0.1	0.5	3	1.0	4	0.5	2	0.5	3	1.0	4
79	Refrigerator	0.2	0.1	0.1	0.1	8.0	46	4.0	15	4.0	15	8.0	46	4.0	15
80	Microwave	1.5	0.7	0.7	0.7	0.5	23	1.0	30	0.5	15	0.5	23	1.0	30
81	Sink Heater	9.0	4.1	4.1	4.1	2.0	540	4.0	720	2.0	360	2.0	540	4.0	720
82	Slicer	0.3	0.1	0.1	0.1	0.5	4	0.5	3	0.5	3	0.5	4	0.5	3
83	Disposer	1.5	0.7	0.7	0.7	0.5	23	0.5	15	0.5	15	0.5	23	0.5	15
84	Booster Heater	45.0	31.5	31.5	31.5	0.5	675	2.0	1,800	2.0	1,800	0.5	675	2.0	1,800
85	Dishwasher	15.0	10.5	10.5	10.5	0.5	225	2.0	600	2.0	600	0.5	225	2.0	600
86	Washer	0.2	0.1	0.1	0.1	0.5	3	2.0	8	1.0	4	0.5	3	2.0	8
87	Disposers	0.6	0.3	0.3	0.3	0.5	8	2.0	22	1.0	11	0.5	8	2.0	22
88	Milk Dispensers	0.2	0.1	0.1	0.1	0.5	2	2.0	6	1.0	3	0.5	2	2.0	6
89	Coffee Maker	15.0	10.5	10.5	10.5	2.0	900	4.0	1,200	2.0	600	2.0	900	4.0	1,200

1

Electric Model
Building 62
Table 5.3.1

Intermediate Billing Months: Off-Peak hrs/day	Off-Peak kWh/Mo	Inter. hrs/day	Inter. kWh/Mo	On-Peak hrs/day	On-Peak kWh/Mo	Summer Billing Months: Off-Peak hrs/day	Off-Peak kWh/Mo	Inter. hrs/day	Inter. kWh/Mo	On-Peak hrs/day	On-Peak kWh/Mo	Non-Summer: Demand kW/Yr.	Off-Peak KWH/Yr.	Inter KWH/Yr.	On-Peak KWH/Yr.	Cost $	Demand kW/Yr.	Off-Peak KWH/Yr.
0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0
0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0
0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0
0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0
0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0
	149		472		700		149		472		700	36	1,043	3,304	4,900	$686	26	745
5.0	750	2.0	200	2.0	200	5.0	750	2.0	200	2.0	200	14	5,250	1,400	1,400	$425	10	3,750
	899		672		900		899		672		900	52	6,977	4,968	6,564	$1,174	36	4,495
9.5	114	5.5	44	5.5	44	9.5	114	5.5	44	5.5	44	2	798	308	308	$74	2	570
9.5	114	5.5	44	5.5	44	9.5	114	5.5	44	5.5	44	2	798	308	308	$74	2	570
9.5	34	5.5	13	5.5	13	9.5	34	5.5	13	5.5	13	1	239	92	92	$22	0	171
	3,578		6,017		8,489		3,578		6,017		8,489	421	25,046	42,119	59,423	$8,790	301	17,890
5.0	4,650	2.0	1,240	2.0	1,240	5.0	4,650	2.0	1,240	2.0	1,240	87	32,550	8,680	8,680	$2,637	62	23,250
	8,490		7,358		9,830		8,490		7,358		9,830	512	59,431	51,507	68,811	$11,597	366	42,451
9.5	103	5.5	40	5.5	40	9.5	103	5.5	40	5.5	40	2	718	277	277	$66	1	513
9.5	214	5.5	83	5.5	83	9.5	214	5.5	83	5.5	83	4	1,496	578	578	$139	3	1,069
9.5	54	5.5	21	5.5	21	9.5	54	5.5	21	5.5	21	1	379	146	146	$35	1	271
9.5	71	5.5	28	5.5	28	9.5	71	5.5	28	5.5	28	1	499	193	193	$46	1	356
	533		5,384		7,995		533		5,384		7,995	412	3,731	37,688	55,965	$7,554	294	2,665
5.0	3,450	2.0	920	2.0	920	5.0	3,450	2.0	920	2.0	920	64	24,150	6,440	6,440	$1,956	46	17,250
	4,425		6,475		9,086		4,425		6,475		9,086	484	30,973	45,322	63,599	$9,797	346	22,124
	56		2,505		3,745		56		2,505		3,745	191	392	17,535	26,215	$3,472	137	280
5.0	750	2.0	200	2.0	200	5.0	750	2.0	200	2.0	200	14	5,250	1,400	1,400	$425	10	3,750
	806		2,705		3,945		806		2,705		3,945	205	5,642	18,935	27,615	$3,897	147	4,030
5	2,138	5.5	825	5.5	825	9.5	2,138	5.5	825	5.5	825	39	14,963	5,775	5,775	$1,385	28	10,688
5	214	5.5	83	5.5	83	9.5	214	5.5	83	5.5	83	4	1,496	578	578	$139	3	1,069
5	171	5.5	66	5.5	66	9.5	171	5.5	66	5.5	66	3	1,197	462	462	$111	2	855
5	143	5.5	55	5.5	55	9.5	143	5.5	55	5.5	55	3	998	385	385	$92	2	713
5	143	5.5	55	5.5	55	9.5	143	5.5	55	5.5	55	3	998	385	385	$92	2	713
5	314	5.5	121	5.5	121	9.5	314	5.5	121	5.5	121	6	2,195	847	847	$203	4	1,568
													0	0	0	$0		0
5	6,384	5.5	2,464	5.5	2,464	9.5	6,384	5.5	2,464	5.5	2,464	118	44,688	17,248	17,248	$4,137	84	31,920
													0	0	0	$0		0
5	1,055	5.5	407	5.5	407	9.5	1,055	5.5	407	5.5	407	19	7,382	2,849	2,849	$683	14	5,273
5	3,192	5.5	1,232	5.5	1,232	9.5	3,192	5.5	1,232	5.5	1,232	59	22,344	8,624	8,624	$2,069	42	15,960
5	214	5.5	83	5.5	83	9.5	214	5.5	83	5.5	83	4	1,496	578	578	$139	3	1,069
5	71	5.5	28	5.5	28	9.5	71	5.5	28	5.5	28	1	499	193	193	$46	1	356
	3,543		10,221		15,278		3,543		10,221		15,278	781	24,801	71,547	106,946	$15,028	558	17,715
0	6,600	2.0	1,760	2.0	1,760	5.0	6,600	2.0	1,760	2.0	1,760	123	46,200	12,320	12,320	$3,742	88	33,000
	24,179		17,399		22,456		24,179		17,399		22,456	1,162	169,255	121,790	157,189	$27,867	830	120,896
5	14,280	4.5	5,040	4.5	5,040	8.5	14,280	4.5	5,040	4.5	5,040	294	99,960	35,280	35,280	$9,132	210	71,400
5	5,712	4.5	2,016	4.5	2,016	8.5	5,712	4.5	2,016	4.5	2,016	118	39,984	14,112	14,112	$3,653	84	28,560
	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0
	214	5.5	83	5.5	83	9.5	214	5.5	83	5.5	83	4	1,496	578	578	$139	3	1,069
	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0
													0	0	0	$0		0
	105	5.5	41	5.5	41	9.5	105	5.5	41	5.5	41	2	738	285	285	$68	1	527
	160	5.5	62	5.5	62	9.5	160	5.5	62	5.5	62	3	1,117	431	431	$103	2	798
	34	5.5	13	5.5	13	9.5	34	5.5	13	5.5	13	1	239	92	92	$22	0	171
	71	5.5	28	5.5	28	9.5	71	5.5	28	5.5	28	1	499	193	193	$46	1	356
	34	5.5	13	5.5	13	9.5	34	5.5	13	5.5	13	1	239	92	92	$22	0	171
	54	5.5	21	5.5	21	9.5	54	5.5	21	5.5	21	1	379	146	146	$35	1	271
	34	5.5	13	5.5	13	9.5	34	5.5	13	5.5	13	1	239	92	92	$22	0	171
	57	5.5	22	5.5	22	9.5	57	5.5	22	5.5	22	1	399	154	154	$37	1	285
	34	5.5	13	5.5	13	9.5	34	5.5	13	5.5	13	1	239	92	92	$22	0	171
	1,937		8,638		12,935		1,937		8,638		12,935	662	13,559	60,466	90,545	$12,448	473	9,685
	3,900	2.0	1,040	2.0	1,040	5.0	3,900	2.0	1,040	2.0	1,040	73	27,300	7,280	7,280	$2,211	52	19,500
	26,627		17,042		21,339		26,627		17,042		21,339	1,161	186,663	119,400	149,479	$27,986	829	133,135
	15	2.0	10	2.0	10	2.0	15	2.0	10	2.0	10	1	105	70	70	$16	1	75
	3	1.0	4	0.5	2	0.5	3	1.0	4	0.5	2	1	20	27	13	$7	0	14
	46	4.0	15	4.0	15	8.0	46	4.0	15	4.0	15	1	319	106	106	$26	0	228
	23	1.0	30	0.5	15	0.5	23	1.0	30	0.5	15	5	158	210	105	$52	3	113
	540	4.0	720	2.0	360	2.0	540	4.0	720	2.0	360	28	3,780	5,040	2,520	$692	20	2,700
	4	0.5	3	0.5	3	0.5	4	0.5	3	0.5	3	1	26	18	18	$8	1	19
	23	0.5	15	0.5	15	0.5	23	0.5	15	0.5	15	5	158	105	105	$47	3	113
	675	2.0	1,800	2.0	1,800	0.5	675	2.0	1,800	2.0	1,800	221	4,725	12,600	12,600	$2,878	158	3,375
	225	2.0	600	2.0	600	0.5	225	2.0	600	2.0	600	74	1,575	4,200	4,200	$959	53	1,125
	3	2.0	8	1.0	4	0.5	3	2.0	8	1.0	4	1	20	53	27	$9	0	14
	8	2.0	22	1.0	11	0.5	8	2.0	22	1.0	11	2	59	157	78	$25	1	42
	2	2.0	6	1.0	3	0.5	2	2.0	6	1.0	3	0	16	42	21	$7	0	11
	900	4.0	1,200	2.0	600	2.0	900	4.0	1,200	2.0	600	74	6,300	8,400	4,200	$1,327	53	4,500

2

mmer ter H/Yr.	On-Peak KWH/Yr.	Cost $	Summer Demand kW/Yr.	Off-Peak KWH/Yr.	Inter KWH/Yr.	On-Peak KWH/Yr.	Cost $	No.
								1
								2
								3
53	53	$13	0	0	0	0	$0	4
53	53	$13	0	0	0	0	$0	5
53	53	$13	0	0	0	0	$0	6
								7
								8
53	53	$13	0	0	0	0	$0	9
53	53	$13	0	0	0	0	$0	10
3,304	4,900	$686	26	745	2,360	3,500	$789	11
1,400	1,400	$425	10	3,750	1,000	1,000	$407	12
4,968	**6,564**	**$1,174**	**36**	**4,495**	**3,360**	**4,500**	**$1,196**	13
								14
								15
308	308	$74	2	570	220	220	$69	16
308	308	$74	2	570	220	220	$69	17
92	92	$22	0	171	66	66	$21	18
2,119	59,423	$8,790	301	17,890	30,085	42,445	$9,789	19
8,680	8,680	$2,637	62	23,250	6,200	6,200	$2,526	20
1,507	**68,811**	**$11,597**	**366**	**42,451**	**36,791**	**49,151**	**$12,474**	21
								22
								23
277	277	$66	1	513	198	198	$62	24
								25
578	578	$139	3	1,069	413	413	$129	26
								27
146	146	$35	1	271	105	105	$33	28
193	193	$46	1	356	138	138	$43	29
.688	55,965	$7,554	294	2,665	26,920	39,975	$8,859	30
.440	6,440	$1,956	46	17,250	4,600	4,600	$1,874	31
.322	**63,599**	**$9,797**	**346**	**22,124**	**32,373**	**45,428**	**$11,000**	32
								33
.535	26,215	$3,472	137	280	12,525	18,725	$4,092	34
400	1,400	$425	10	3,750	1,000	1,000	$407	35
.935	**27,615**	**$3,897**	**147**	**4,030**	**13,525**	**19,725**	**$4,499**	36
								37
								38
775	5,775	$1,385	28	10,688	4,125	4,125	$1,294	39
578	578	$139	3	1,069	413	413	$129	40
462	462	$111	2	855	330	330	$103	41
385	385	$92	2	713	275	275	$86	42
385	385	$92	2	713	275	275	$86	43
847	847	$203	4	1,568	605	605	$190	44
0	0	$0		0	0	0	$0	45
248	17,248	$4,137	84	31,920	12,320	12,320	$3,864	46
0	0	$0		0	0	0	$0	47
49	2,849	$683	14	5,273	2,035	2,035	$638	48
24	8,624	$2,069	42	15,960	6,160	6,160	$1,932	49
78	578	$139	3	1,069	413	413	$129	50
93	193	$46	1	356	138	138	$43	51
47	106,946	$15,028	558	17,715	51,105	76,390	$17,268	52
20	12,320	$3,742	88	33,000	8,800	8,800	$3,585	53
90	**157,189**	**$27,867**	**830**	**120,896**	**86,993**	**112,278**	**$29,348**	54
								55
								56
30	35,280	$9,132	210	71,400	25,200	25,200	$8,763	57
12	14,112	$3,653	84	28,560	10,080	10,080	$3,505	58
53	53	$13	0	0	0	0	$0	59
78	578	$139	3	1,069	413	413	$129	60
53	53	$13	0	0	0	0	$0	61
0	0	$0		0	0	0	$0	62
5	285	$68	1	527	204	204	$64	63
1	431	$103	2	798	308	308	$97	64
2	92	$22	0	171	66	66	$21	65
3	193	$46	1	356	138	138	$43	66
2	92	$22	0	171	66	66	$21	67
6	146	$35	1	271	105	105	$33	68
2	92	$22	0	171	66	66	$21	69
4	154	$37	1	285	110	110	$34	70
2	92	$22	0	171	66	66	$21	71
	90,545	$12,448	473	9,685	43,190	64,675	$14,444	72
	7,280	$2,211	52	19,500	5,200	5,200	$2,118	73
	149,479	**$27,986**	**829**	**133,135**	**85,210**	**106,695**	**$29,314**	74
								75
								76
	70	$16	1	75	50	50	$18	77
	13	$7	0	14	19	10	$9	78
	106	$26	0	228	76	76	$23	79
	105	$52	3	113	150	75	$73	80
	2,520	$692	20	2,700	3,600	1,800	$719	81
	18	$8	1	19	13	13	$12	82
	105	$47	3	113	75	75	$70	83
	12,000	$2,878	158	3,375	9,000	9,000	$3,787	84
	4,200	$959	53	1,125	3,000	3,000	$1,262	85
	27	$9	0	14	38	19	$11	86
	78	$25	1	42	112	56	$32	87
	21	$7	0	11	30	15	$8	88
	4,200	$1,327	53	4,500	6,000	3,000	$1,518	89

No.	Description	Total Connecte Load (k	Winter Demand kW/Month	Inter Demand kW/Month	Summer Demand kW/Month	Winter Billing Months Off-Peak hrs/day	Winter Off-Peak kWh/Mo	Winter Inter. hrs/day	Winter Inter. kWh/Mo	Winter On-Peak hrs/day	Winter On-Peak kWh/Mo	Intermediate Billing Off-Peak hrs/day	Intermediate Off-Peak kWh/Mo	Intermediate Inter. hrs/day	Intermediate Inter. kWh/M
90	Ice Maker	1.1	0.5	0.5	0.5	8.0	264	4.0	88	4.0	88	8.0	264	4.0	
91	Banquet Carts	3.0	1.4	1.4	1.4	0.5	45	0.5	30	0.5	30	0.5	45	0.5	
92	Refrig./Freezer	0.4	0.2	0.2	0.2	8.0	89	4.0	30	4.0	30	8.0	89	4.0	
93	Char Broiler	10.0	7.0	7.0	7.0	2.0	600	4.0	800	2.0	400	2.0	600	4.0	
94	Griddle	12.0	8.4	8.4	8.4	2.0	720	4.0	960	2.0	480	2.0	720	4.0	
95	Fryer	11.4	8.0	8.0	8.0	2.0	684	4.0	912	2.0	456	2.0	684	4.0	
96	Bun Warmer	0.2	0.1	0.1	0.1	0.5	3	4.0	15	1.0	4	0.5	3	4.0	
97	Plate Warmer	1.0	0.5	0.5	0.5	0.5	15	2.0	40	1.0	20	0.5	15	2.0	
98	Hot Food Center	6.2	2.8	2.8	2.8	0.5	93	2.0	248	1.0	124	0.5	93	2.0	
99	Bowel Lowerator	1.0	0.5	0.5	0.5	0.5	15	0.5	10	0.5	10	0.5	15	0.5	
100	Toaster	2.6	1.2	1.2	1.2	0.5	39	2.0	104	1.0	52	0.5	39	2.0	
101	Food Warmer	0.8	0.4	0.4	0.4	0.5	12	2.0	32	1.0	16	0.5	12	2.0	
102	Roll Warmer	0.8	0.4	0.4	0.4	0.5	12	2.0	32	1.0	16	0.5	12	2.0	
103	Hot Serve Cabinet	1.7	0.8	0.8	0.8	0.5	26	2.0	68	1.0	34	0.5	26	2.0	
104	Soup Servers	1.6	0.7	0.7	0.7	0.5	24	2.0	64	1.0	32	0.5	24	2.0	
105	Sandwich Units	0.3	0.1	0.1	0.1	0.5	4	2.0	10	1.0	5	0.5	4	2.0	
106	Soft Ice Cream	5.7	2.6	2.6	2.6	0.5	86	2.0	228	1.0	114	0.5	86	2.0	2
107	Salad Bar	0.2	0.1	0.1	0.1	0.5	3	2.0	8	1.0	4	0.5	3	2.0	
108	Iced Tea Dispenser	0.1	0.0	0.0	0.0	0.5	2	2.0	4	1.0	2	0.5	2	2.0	
109	Juice Dispenser	0.7	0.3	0.3	0.3	0.5	10	2.0	26	1.0	13	0.5	10	2.0	
110	Soda Dispenser	0.2	0.1	0.1	0.1	0.5	3	2.0	8	1.0	4	0.5	3	2.0	
111	Milk Dispenser	0.2	0.1	0.1	0.1	0.5	3	2.0	8	1.0	4	0.5	3	2.0	
112	Coffee Maker	15.0	10.5	10.5	10.5	2.0	900	4.0	1,200	2.0	600	2.0	900	4.0	1,2
113	Soft Ice Cream	5.7	2.6	2.6	2.6	0.5	86	2.0	228	1.0	114	0.5	86	2.0	2
114	Soft Ice Cream	5.7	2.6	2.6	2.6	0.5	86	2.0	228	1.0	114	0.5	86	2.0	2
115	Toaster	2.6	1.2	1.2	1.2	0.5	39	2.0	104	1.0	52	0.5	39	2.0	1
116	Plate Lowerator	1.0	0.5	0.5	0.5	0.5	15	2.0	40	1.0	20	0.5	15	2.0	
117	Disposer	0.6	0.3	0.3	0.3	0.5	8	2.0	22	0.5	6	0.5	8	2.0	
118	Refrig	1.6	0.7	0.7	0.7	8.0	384	4.0	128	4.0	128	8.0	384	4.0	1
119	Refrig	1.6	0.7	0.7	0.7	8.0	384	4.0	128	4.0	128	8.0	384	4.0	1
120	Vegetable Cutter	0.3	0.1	0.1	0.1	0.5	4	0.5	3	0.5	3	0.5	4	0.5	
121	Blender	0.4	0.2	0.2	0.2	0.5	6	0.5	4	0.5	4	0.5	6	0.5	
122	Mixer	0.4	0.2	0.2	0.2	0.5	6	0.5	4	0.5	4	0.5	6	0.5	
123	Range Hood Exhaust Fan 7A	1.5	1.1	1.1	1.1	2.0	90	4.0	120	2.0	60	2.0	90	4.0	12
124	Range Hood Exhaust Fan 7B	0.6	0.4	0.4	0.4	2.0	34	4.0	45	2.0	22	2.0	34	4.0	4
125	Unit Heater 7	0.1	0.1	0.0	0.0	9.0	32	5.5	13	5.5	13	0.0	0	0.0	
126	Lighting	13.1	12.2	12.2	12.2		566		1,117		1,675		566		1,11
127	Sub-totals	199.8	127.7	127.7	127.7		7,853		11,540		8,317		7,821		11,52
128	AHU-8														
129	*Ground Floor:*														
130	Air Handler 1N	3.7	2.8	2.8	2.8	9.5	1,055	5.5	407	5.5	407	9.5	1,055	5.5	40
131	Smoke Supply Fan 1	15.0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
132	Cabinet Unit Heater 2A	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	
133	Cabinet Unit Heater 2E	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	
134	Cabinet Unit Heater 3W	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	
135	*Second Floor:*														
136	Air Handler 8	18.7	14.0	14.0	14.0	9.5	5,330	5.5	2,057	5.5	2,057	9.5	5,330	5.5	2,057
137	*Third Floor:*														
138	Return Air Fan 1N	2.2	1.7	1.7	1.7	9.5	627	5.5	242	5.5	242	9.5	627	5.5	242
139	Return Air Fan 8	11.2	8.4	8.4	8.4	9.5	3,192	5.5	1,232	5.5	1,232	9.5	3,192	5.5	1,232
140	Exhaust Fan 16	0.6	0.4	0.4	0.4	9.5	160	5.5	62	5.5	62	9.5	160	5.5	62
141	Lighting	50.5	46.3	46.3	46.3		1,048		4,268		6,308		1,048		4,268
142	Miscellaneous Equip	33.0	13.2	13.2	13.2	5.0	4,950	2.0	1,320	2.0	1,320	5.0	4,950	2.0	1,320
143	Sub-totals	135.2	87.0	86.8	86.8		16,463		9,627		11,667		16,361		9,588
144	AHU-9														
145	*Third Floor:*														
146	Air Handler 9	3.7	2.8	2.8	2.8	9.5	1,055	5.5	407	5.5	407	9.5	1,055	5.5	407
147	Smoke Supply Fan 9	0.3	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
148	Return Air Fan 9	0.8	0.6	0.6	0.6	9.5	214	5.5	83	5.5	83	9.5	214	5.5	83
149	Air-cooled Chiller	21.0	10.5	10.5	17.6	8.0	5,040	4.0	1,680	4.0	1,680	8.0	5,040	5.0	2,100
150	Chilled Water Pump 7	0.4	0.3	0.3	0.3	8.0	89	4.0	30	4.0	30	8.0	89	4.0	30
151	Lighting														
152	Miscellaneous Equip	3.0	1.2	1.2	1.2	5.0	450	2.0	120	2.0	120	5.0	450	2.0	120
153	Sub-totals	29.1	15.3	15.3	22.5		6,847		2,319		2,319		6,847		2,739
154	MISC.														
155	Air Handler 7	5.6	4.2	4.2	4.2	9.5	1,596	5.5	616	5.5	616	9.5	1,596	5.5	616
156	Return Air Fan 7	1.1	0.8	0.8	0.8	9.5	314	5.5	121	5.5	121	9.5	314	5.5	121
157	Transfer Fan TF-7D	0.4	0.3	0.3	0.3	9.5	114	5.5	44	5.5	44	9.5	114	5.5	44
158	Transfer Fan TF-7E	0.4	0.3	0.3	0.3	9.5	114	5.5	44	5.5	44	9.5	114	5.5	44
159	Air Handler 2	30.0	22.5	22.5	22.5	8.5	7,650	4.5	2,700	4.5	2,700	8.5	7,650	4.5	2,700
160	Return Air Fan 2	15.0	11.3	11.3	11.3	8.5	3,825	4.5	1,350	4.5	1,350	8.5	3,825	4.5	1,350
161	Air Handler 3	15.0	11.3	11.3	11.3	8.5	3,825	4.5	1,350	4.5	1,350	8.5	3,825	4.5	1,350
162	Return Air Fan 3	7.5	5.6	5.6	5.6	8.5	1,913	4.5	675	4.5	675	8.5	1,913	4.5	675
163	Air Handler 4	11.2	8.4	8.4	8.4	9.5	3,192	5.5	1,232	5.5	1,232	9.5	3,192	5.5	1,232
164	Return Air Fan 4	5.6	4.2	4.2	4.2	9.5	1,596	5.5	616	5.5	616	9.5	1,596	5.5	616
165	Kitchen Make-up Air Unit 1	3.7	2.8	2.8	2.8	2.0	222	4.0	296	4.0	296	2.0	222	4.0	296
166	Chiller CH-1	299.0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
167	Chiller CH-2	191.0	42.6	101.9	191.0	3.7	21,294	1.6	6,002	2.4	9,214	3.7	21,294	2.5	9,406
168	Boiler B-1	2.2	1.7	0.0	0.0	9.5	627	5.5	242	5.5	242	0.0	0	0.0	0
169	Boiler B-2	1.5	1.1	1.1	0.8	9.5	428	5.5	165	5.5	165	9.5	428	5.5	165
170	Hot Water Pump P-1	7.5	5.6	5.6	0.0	9.5	2,138	5.5	825	5.5	825	0.0	0	0.0	0
171	Hot Water Pump P-2	7.5	5.6	5.6	5.6	9.5	2,138	5.5	825	5.5	825	9.5	2,138	5.5	825
172	Chilled Water Pump P-3	11.2	8.4	8.4	8.4	9.5	3,192	5.5	1,232	5.5	1,232	9.5	3,192	5.5	1,232
	Chilled Water Pump P-4	22.4	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Cooling Tower Pump P-5	15.0	11.3	11.3	11.3	9.5	4,275	5.5	1,650	5.5	1,650	9.5	4,275	5.5	1,650
175	Cooling Tower Pump P-6	22.4	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
176	Cooling Tower, Fans	41.5	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	1.7	2,088	1.4	1,162
177	Cooling Tower, Fans	41.5	0.0	31.1	31.1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
178	Unit Heater 1A	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	0
179	Unit Heater 1B	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	0

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Electric Model
Building 62
Table 5.3.1

Intermediate Billing Months					Summer Billing Months						Non-Summer					Summer		
ak	Inter.		On-Peak		Off-Peak		Inter.		On-Peak									
h/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	Demand kW/Yr.	Off-Peak KWH/Yr.	Inter KWH/Yr.	On-Peak KWH/Yr.	Cost $	Demand kW/Yr.	Off-Peak KWH/Yr.	Inter KWH/Yr
264	4.0	88	4.0	88	8.0	264	4.0	88	4.0	88	3	1,848	616	616	$152	2	1,320	4
45	0.5	30	0.5	30	0.5	45	0.5	30	0.5	30	9	315	210	210	$95	7	225	1
89	4.0	30	4.0	30	8.0	89	4.0	30	4.0	30	1	622	207	207	$51	1	444	1
600	4.0	800	2.0	400	2.0	600	4.0	800	2.0	400	49	4,200	5,600	2,800	$885	35	3,000	4,0
720	4.0	960	2.0	480	2.0	720	4.0	960	2.0	480	59	5,040	6,720	3,360	$1,062	42	3,600	4,8
684	4.0	912	2.0	456	2.0	684	4.0	912	2.0	456	56	4,788	6,384	3,192	$1,009	40	3,420	4,5
3	4.0	15	1.0	4	0.5	3	4.0	15	1.0	4	1	20	106	26	$11	0	14	
15	2.0	40	1.0	20	0.5	15	2.0	40	1.0	20	3	105	280	140	$45	2	75	2
93	2.0	248	1.0	124	0.5	93	2.0	248	1.0	124	20	651	1,736	868	$279	14	465	1,2
15	0.5	10	0.5	10	0.5	15	0.5	10	0.5	10	3	105	70	70	$32	2	75	
39	2.0	104	1.0	52	0.5	39	2.0	104	1.0	52	8	273	728	364	$117	6	195	5
12	2.0	32	1.0	16	0.5	12	2.0	32	1.0	16	3	84	224	112	$36	2	60	1
12	2.0	32	1.0	16	0.5	12	2.0	32	1.0	16	3	84	224	112	$36	2	60	1
26	2.0	68	1.0	34	0.5	26	2.0	68	1.0	34	5	179	476	238	$76	4	128	3
24	2.0	64	1.0	32	0.5	24	2.0	64	1.0	32	5	168	448	224	$72	4	120	3
4	2.0	10	1.0	5	0.5	4	2.0	10	1.0	5	1	26	70	35	$11	1	19	5
86	2.0	228	1.0	114	0.5	86	2.0	228	1.0	114	18	599	1,596	798	$256	13	428	1,14
3	2.0	8	1.0	4	0.5	3	2.0	8	1.0	4	1	20	53	27	$9	0	14	3
2	2.0	4	1.0	2	0.5	2	2.0	4	1.0	2	0	12	31	15	$5	0	8	2
10	2.0	26	1.0	13	0.5	10	2.0	26	1.0	13	2	68	182	91	$29	1	49	13
3	2.0	8	1.0	4	0.5	3	2.0	8	1.0	4	1	20	53	27	$9	0	14	3
3	2.0	8	1.0	4	0.5	3	2.0	8	1.0	4	1	20	53	27	$9	0	14	3
900	4.0	1,200	2.0	600	2.0	900	4.0	1,200	2.0	600	74	6,300	8,400	4,200	$1,327	53	4,500	6,00
86	2.0	228	1.0	114	0.5	86	2.0	228	1.0	114	18	599	1,596	798	$256	13	428	1,14
86	2.0	228	1.0	114	0.5	86	2.0	228	1.0	114	18	599	1,596	798	$256	13	428	1,14
39	2.0	104	1.0	52	0.5	39	2.0	104	1.0	52	8	273	728	364	$117	6	195	52
15	2.0	40	1.0	20	0.5	15	2.0	40	1.0	20	3	105	280	140	$45	2	75	20
8	2.0	22	0.5	6	0.5	8	2.0	22	0.5	6	2	59	157	39	$23	1	42	11
384	4.0	128	4.0	128	8.0	384	4.0	128	4.0	128	5	2,688	896	896	$221	4	1,920	64
384	4.0	128	4.0	128	8.0	384	4.0	128	4.0	128	5	2,688	896	896	$221	4	1,920	64
4	0.5	3	0.5	3	0.5	4	0.5	3	0.5	3	1	26	18	18	$8	1	19	13
6	0.5	4	0.5	4	0.5	6	0.5	4	0.5	4	1	39	26	26	$12	1	28	19
6	0.5	4	0.5	4	0.5	6	0.5	4	0.5	4	1	39	26	26	$12	1	28	19
90	4.0	120	2.0	60	2.0	90	4.0	120	2.0	60	8	630	840	420	$136	6	450	600
34	4.0	45	2.0	22	2.0	34	4.0	45	2.0	22	3	235	314	157	$51	2	168	224
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	130	53	53	$12	0	0	0
566		1,117		1,675		566		1,117		1,675	85	3,962	7,819	11,725	$1,691	61	2,830	5,585
821		**11,527**		**8,303**		**7,821**		**11,527**		**8,303**	**894**	**54,876**	**80,738**	**58,177**	**$14,728**	**638**	**39,104**	**57,633**
055	5.5	407	5.5	407	9.5	1,055	5.5	407	5.5	407	19	7,382	2,849	2,849	$683	14	5,273	2,035
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0	0
												0	0	0	$0		0	0
30	5.5	2,057	5.5	2,057	9.5	5,330	5.5	2,057	5.5	2,057	98	37,307	14,399	14,399	$3,454	70	26,648	10,285
												0	0	0	$0		0	0
27	5.5	242	5.5	242	9.5	627	5.5	242	5.5	242	12	4,389	1,694	1,694	$406	8	3,135	1,210
92	5.5	1,232	5.5	1,232	9.5	3,192	5.5	1,232	5.5	1,232	59	22,344	8,624	8,624	$2,069	42	15,960	6,160
60	5.5	62	5.5	62	9.5	160	5.5	62	5.5	62	3	1,117	431	431	$103	2	798	308
48		4,268		6,308		1,048		4,000		6,308	324	7,336	29,876	44,156	$6,125	232	5,240	19,998
50	2.0	1,320	2.0	1,320	5.0	4,950	2.0	1,320	2.0	1,320	92	34,650	9,240	9,240	$2,807	66	24,750	6,600
51		**9,588**		**11,628**		**16,361**		**9,319**		**11,628**	**608**	**114,935**	**67,272**	**81,552**	**$15,685**	**434**	**81,803**	**46,596**
5	5.5	407	5.5	407	9.5	1,055	5.5	407	5.5	407	19	7,382	2,849	2,849	$683	14	5,273	2,035
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
4	5.5	83	5.5	83	9.5	214	5.5	83	5.5	83	4	1,496	578	578	$139	3	1,069	413
0	5.0	2,100	5.0	2,100	9.0	5,670	6.0	2,520	6.0	2,520	74	35,280	13,020	13,020	$3,079	88	28,350	12,600
9	4.0	30	4.0	30	8.0	89	4.0	30	4.0	30	2	622	207	207	$55	1	444	148
												0	0	0	$0		0	0
)	2.0	120	2.0	120	5.0	450	2.0	120	2.0	120	8	3,150	840	840	$255	6	2,250	600
7		**2,739**		**2,739**		**7,477**		**3,159**		**3,159**	**107**	**47,929**	**17,494**	**17,494**	**$4,212**	**112**	**37,385**	**15,796**
	5.5	616	5.5	616	9.5	1,596	5.5	616	5.5	616	29	11,172	4,312	4,312	$1,034	21	7,980	3,080
	5.5	121	5.5	121	9.5	314	5.5	121	5.5	121	6	2,195	847	847	$203	4	1,568	605
	5.5	44	5.5	44	9.5	114	5.5	44	5.5	44	2	798	308	308	$74	2	570	220
	5.5	44	5.5	44	9.5	114	5.5	44	5.5	44	2	798	308	308	$74	2	570	220
	4.5	2,700	4.5	2,700	8.5	7,650	4.5	2,700	4.5	2,700	158	53,550	18,900	18 900	$4,892	113	38,250	13,500
	4.5	1,350	4.5	1,350	8.5	3,825	4.5	1,350	4.5	1,350	79	26,775	9,450	9,450	$2,446	56	19,125	6,750
	4.5	1,350	4.5	1,350	8.5	3,825	4.5	1,350	4.5	1,350	79	26,775	9,450	9,450	$2,446	56	19,125	6,750
	4.5	675	4.5	675	8.5	1,913	4.5	675	4.5	675	39	13,388	4,725	4,725	$1,223	28	9,563	3,375
	5.5	1,232	5.5	1,232	9.5	3,192	5.5	1,232	5.5	1,232	59	22,344	8,624	8,624	$2,069	42	15,960	6,160
	5.5	616	5.5	616	9.5	1,596	5.5	616	5.5	616	29	11,172	4,312	4,312	$1,034	21	7,980	3,080
	4.0	296	2.0	148	2.0	222	4.0	296	2.0	148	19	1,554	2,072	1,628	$367	14	1,110	1,480
	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
	2.5	9,406	3.5	13,236	9.5	54,459	6.4	24,639	7.1	27,081	476	149,057	52,224	76,563	$15,118	955	272,294	123,193
	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	7	2,508	968	968	$232	0	0	0
	5.5	165	5.5	165	6.0	270	4.0	120	5.5	165	8	2,993	1,155	1,155	$277	4	1,350	600
	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	39	8,550	3,300	3,300	$903	0	0	0
	5.5	825	5.5	825	9.5	2,138	5.5	825	5.5	825	39	14,963	5,775	5,775	$1,385	28	10,688	4,125
	5.5	1,232	5.5	1,232	9.5	3,192	5.5	1,232	5.5	1,232	59	22,344	8,624	8,624	$2,069	42	15,960	6,160
	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
	5.5	1,650	5.5	1,650	9.5	4,275	5.5	1,650	5.5	1,650	79	29,925	11,550	11,550	$2,770	56	21,375	8,250
	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
	1.4	1,162	2.0	1,677	8.0	10,010	6.0	4,980	7.0	5,810	0	6,265	3,486	5,030	$659	0	50,049	24,900
	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	93	0	0	0	$616	156	0	0
	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0	0
	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0	0

2

mmer			Summer					
ter 1/Yr.	On-Peak KWH/Yr.	Cost $	Demand kW/Yr.	Off-Peak KWH/Yr.	Inter KWH/Yr.	On-Peak KWH/Yr.	Cost $	No.
616	616	$152	2	1,320	440	440	$135	90
210	210	$95	7	225	150	150	$139	91
207	207	$51	1	444	148	148	$45	92
5,600	2,800	$885	35	3,000	4,000	2,000	$1,012	93
6,720	3,360	$1,062	42	3,600	4,800	2,400	$1,215	94
6,384	3,192	$1,009	40	3,420	4,560	2,280	$1,154	95
106	26	$11	0	14	76	19	$12	96
280	140	$45	2	75	200	100	$57	97
1,736	868	$279	14	465	1,240	620	$351	98
70	70	$32	2	75	50	50	$46	99
728	364	$117	6	195	520	260	$147	100
224	112	$36	2	60	160	80	$45	101
224	112	$36	2	60	160	80	$45	102
476	238	$76	4	128	340	170	$96	103
448	224	$72	4	120	320	160	$91	104
70	35	$11	1	19	50	25	$14	105
1,596	798	$256	13	428	1,140	570	$323	106
53	27	$9	0	14	38	19	$11	107
31	15	$5	0	8	22	11	$6	108
182	91	$29	1	49	130	65	$37	109
53	27	$9	0	14	38	19	$11	110
53	27	$9	0	14	38	19	$11	111
,400	4,200	$1,327	53	4,500	6,000	3,000	$1,518	112
,596	798	$256	13	428	1,140	570	$323	113
,596	798	$256	13	428	1,140	570	$323	114
728	364	$117	6	195	520	260	$147	115
280	140	$45	2	75	200	100	$57	116
157	39	$23	1	42	112	28	$30	117
896	896	$221	4	1,920	640	640	$197	118
896	896	$221	4	1,920	640	640	$197	119
18	18	$8	1	19	13	13	$12	120
26	26	$12	1	28	19	19	$17	121
26	26	$12	1	28	19	19	$17	122
840	420	$136	6	450	600	300	$158	123
314	157	$51	2	168	224	112	$59	124
53	53	$12	0	0	0	0	$0	125
819	11,725	$1,691	61	2,830	5,585	8,375	$1,920	126
738	**58,177**	**$14,728**	**638**	**39,104**	**57,633**	**41,517**	**$17,520**	127
								128
								129
49	2,849	$683	14	5,273	2,035	2,035	$638	130
0	0	$0	0	0	0	0	$0	131
53	53	$13	0	0	0	0	$0	132
53	53	$13	0	0	0	0	$0	133
53	53	$13	0	0	0	0	$0	134
0	0	$0		0	0	0	$0	135
99	14,399	$3,454	70	26,648	10,285	10,285	$3,226	136
0	0	$0		0	0	0	$0	137
94	1,694	$406	8	3,135	1,210	1,210	$379	138
24	8,624	$2,069	42	15,960	6,160	6,160	$1,932	139
31	431	$103	2	798	308	308	$97	140
76	44,156	$6,125	232	5,240	19,998	31,540	$7,030	141
40	9,240	$2,807	66	24,750	6,600	6,600	$2,689	142
2	**81,552**	**$15,685**	**434**	**81,803**	**46,596**	**58,138**	**$15,990**	143
								144
								145
19	2,849	$683	14	5,273	2,035	2,035	$638	146
0	0	$0	0	0	0	0	$0	147
8	578	$139	3	1,069	413	413	$129	148
0	13,020	$3,079	88	28,350	12,600	12,600	$3,845	149
7	207	$55	1	444	148	148	$57	150
0	0	$0		0	0	0	$0	151
0	840	$255	6	2,250	600	600	$244	152
4	**17,494**	**$4,212**	**112**	**37,385**	**15,796**	**15,796**	**$4,913**	153
								154
	4,312	$1,034	21	7,980	3,080	3,080	$966	155
	847	$203	4	1,568	605	605	$190	156
	308	$74	2	570	220	220	$69	157
	308	$74	2	570	220	220	$69	158
	18,900	$4,892	113	38,250	13,500	13,500	$4,695	159
	9,450	$2,446	56	19,125	6,750	6,750	$2,347	160
	9,450	$2,446	56	19,125	6,750	6,750	$2,347	161
	4,725	$1,223	28	9,563	3,375	3,375	$1,174	162
	8,624	$2,069	42	15,960	6,160	6,160	$1,932	163
	4,312	$1,034	21	7,980	3,080	3,080	$966	164
	1,628	$367	14	1,110	1,480	740	$390	165
	0	$0	0	0	0	0	$0	166
	76,563	$15,118	955	272,294	123,193	135,406	$39,764	167
	968	$232	0	0	0	0	$0	168
	1,155	$277	4	1,350	600	825	$189	169
	3,300	$903	0	0	0	0	$0	170
	5,775	$1,385	28	10,688	4,125	4,125	$1,294	171
	8,624	$2,069	42	15,960	6,160	6,160	$1,932	172
	0	$0	0	0	0	0	$0	173
	11,550	$2,770	56	21,375	8,250	8,250	$2,587	174
	0	$0	0	0	0	0	$0	175
	5,030	$659	0	50,049	24,900	29,050	$4,673	176
	0	$616	156	0	0	0	$2,660	177
	53	$13	0	0	0	0	$0	178
	53	$13	0	0	0	0	$0	179

B

No.	Description	Total Connecte Load (k	Winter Demand kW/Month	Inter Demand kW/Month	Summer Demand kW/Month	Winter Billing Months Off-Peak hrs/day	Winter Off-Peak kWh/Mo	Winter Inter. hrs/day	Winter Inter. kWh/Mo	Winter On-Peak hrs/day	Winter On-Peak kWh/Mo	Intermediate Billing Off-Peak hrs/day	Intermediate Off-Peak kWh/Mo	Intermediate Inter. hrs/day	Intermediate Inter. kWh/M
180	Unit Heater 2A	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	
181	Unit Heater 2B	.0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	
182	Unit Heater 3A	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	
183	Exhaust Fan 10, Mech Rm.	1.1	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
184	Exhaust Fan 11, Gen. Rm.	0.1	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
185	Exhaust Fan 12A, Trans. Rm	1.5	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
186	Exhaust Fan 13, Elec. Rm.	0.8	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
187	Exhaust Fan 15	0.4	0.3	0.3	0.3	9.5	105	5.5	41	5.5	41	9.5	105	5.5	
188	Exhaust Fan 17, Elev. Mach	0.1	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
189	Exhaust Fan 14	0.4	0.3	0.3	0.3	9.5	105	5.5	41	5.5	41	9.5	105	5.5	
190	Boiler Feed Water Pump	0.6	0.1	0.1	0.1	2.0	34	2.0	22	2.0	22	2.0	34	2.0	
191	ATC Air Compressor	5.6	0.8	1.4	1.4	3.0	504	2.0	224	2.0	224	3.0	504	2.0	[illegible]
192	Elevator #1	22.4	2.2	3.4	3.4	0.0	0	0.5	224	0.5	224	0.0	0	0.5	[illegible]
193	Elevator #2	22.4	2.2	3.4	3.4	0.0	0	0.5	224	0.5	224	0.0	0	0.5	[illegible]
194	Elevator #3	29.8	3.0	4.5	4.5	0.0	0	0.5	298	0.5	298	0.0	0	0.5	[illegible]
195	Elevator #4	22.4	2.2	3.4	3.4	0.0	0	0.5	224	0.5	224	0.0	0	0.5	[illegible]
196	Elevator #5	29.8	3.0	4.5	4.5	0.0	0	0.5	298	0.5	298	0.0	0	0.5	[illegible]
197	Dock Elevator	3.7	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
198	DHW Recirc Pump	0.6	0.3	0.3	0.3	6.0	101	4.0	45	4.0	45	6.0	101	4.0	[illegible]
199	Unit Heater 3B	0.1	0.1	0.0	0.0	9.5	34	5.5	13	5.5	13	0.0	0	0.0	
200	Jockey Pump, Fire	2.2	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
201	Kitchen Remote Cooler	0.4	0.1	0.1	0.1	6.0	68	3.0	23	3.0	23	6.0	68	3.0	[illegible]
202	Kitchen Remote Cooler	0.4	0.1	0.1	0.1	6.0	68	3.0	23	3.0	23	6.0	68	3.0	[illegible]
203	Transfer Fan 1A	0.3	0.2	0.2	0.2	9.5	94	5.5	36	5.5	36	9.5	94	5.5	[illegible]
204	Cooling Tower Heater	7.0	2.8	0.0	0.0	7.3	1,533	3.0	420	3.0	420	0.0	0	0.0	
205	Cooling Tower Heater	7.0	2.8	0.0	0.0	7.3	1,533	3.0	420	3.0	420	0.0	0	0.0	
206	Exhaust Fan 23	0.3	0.2	0.2	0.2	9.5	80	5.5	31	5.5	31	9.5	80	5.5	[illegible]
207	Air Curtain 1	0.3	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
208	Air Curtain 1	0.3	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
209	Condensate Pump 1	0.3	0.1	0.1	0.1	2.0	15	2.0	10	2.0	10	2.0	15	2.0	[illegible]
210	Exhaust Fan 12B	3.7	2.8	2.8	2.8	9.5	1,055	5.5	407	5.5	407	9.5	1,055	5.5	[illegible]
211	Transfer Fan 1B	0.3	0.2	0.2	0.2	9.5	71	5.5	28	5.5	28	9.5	71	5.5	[illegible]
212	Exhaust Fan 4A	0.1	0.1	0.1	0.1	9.5	34	5.5	13	5.5	13	9.5	34	5.5	[illegible]
213	Transfer Fan 6A	1.1	0.8	0.8	0.8	9.5	314	5.5	121	5.5	121	9.5	314	5.5	121
214	Ceiling Fan 1	0.1	0.0	0.0	0.1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	[illegible]
215	Ceiling Fan 1	0.1	0.0	0.0	0.1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
216	Ceiling Fan 1	0.1	0.0	0.0	0.1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
217	Ceiling Fan 1	0.1	0.0	0.0	0.1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
218	Ceiling Fan 1	0.1	0.0	0.0	0.1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
219	ATC Air Dryer	0.2	0.0	0.0	0.0	0.5	3	0.5	2	0.5	2	0.5	3	0.5	2
220	Sewage Pump	0.3	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
221	Sewage Pump	0.3	0.0	0.0	0.0	0.5	4	0.5	3	0.5	3	0.5	4	0.5	3
222	Sewage Ejector	0.8	0.0	0.0	0.0	0.5	11	0.5	8	0.5	8	0.5	11	0.5	8
223	Sprinkler Air Compressor	2.2	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
224	Exterior Lighting	16.7	0.0	0.0	0.0		4,639		1,450		0		4,639		1,450
225	Lighting	24.5	21.0	21.0	21.0		1,384		2,214		3,054		1,384		2,214
226	Sub-totals	969.5	194.2	283.8	367.4		70,411		26,912		29,514		66,464		29,491
227	TOTALS	1,984	936	1,024	1,115		167,240		102,140		119,465		162,918		104,995

Historical Billing Demand Averages

Dec	981	Apr	977	Jun	1,006
Jan	914	May	996	Jul	1,154
Feb	889	Nov	1,099	Aug	1,141
Mar	958			Sep	1,066
				Oct	1,207
Avg	936		1,024		1,115

152,300	Dec	103,260	Dec	126,330
200,420	Jan	98,550	Jan	113,000
158,100	Feb	102,780	Feb	112,230
158,140	Mar	103,970	Mar	126,300
167,240		102,140		119,465

138,960	Apr	103,060
161,600	May	104,930
188,195	Nov	106,995
162,918		104,995

Winter Months, December, January, February, March
Intermediate Months: April, May, November
Summer Months: June, July, August, September, October

	Winter	Summer
Incremental Demand Cost, $/kW	$6.60	$17.09
Off-Peak Incremental Usage Cost, $/kWh	$0.037	$0.034
Intermediate Incremental Usage Cost, $/kWh	$0.046	$0.047
On-Peak Incremental Usage Cost, $/kWh	$0.053	$0.062

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Electric Model
Building 62
Table 5.3.1

	Intermediate Billing Months				Summer Billing Months						Non-Summer					Summer		
	Inter.		On-Peak		Off-Peak		Inter.		On-Peak									
Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	hrs/ day	kWh/Mo	Demand kW/Yr.	Off-Peak KWH/Yr.	Inter KWH/Yr.	On-Peak KWH/Yr.	Cost $	Demand kW/Yr.	Off-Peak KWH/Yr.	Inter KWH/Yr.
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
105	5.5	41	5.5	41	9.5	105	5.5	41	5.5	41	2	738	285	285	$68	1	527	204
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$1	0	0	0
105	5.5	41	5.5	41	9.5	105	5.5	41	5.5	41	2	738	285	285	$68	1	527	204
34	2.0	22	2.0	22	2.0	34	2.0	22	2.0	22	1	235	157	157	$31	1	168	112
504	2.0	224	2.0	224	3.0	504	2.0	224	2.0	224	8	3,528	1,568	1,568	$336	7	2,520	1,120
0	0.5	224	0.5	224	0.0	0	0.5	224	0.5	224	19	0	1,568	1,568	$281	17	0	1,120
0	0.5	224	0.5	224	0.0	0	0.5	224	0.5	224	19	0	1,568	1,568	$281	17	0	1,120
0	0.5	298	0.5	298	0.0	0	0.5	298	0.5	298	25	0	2,086	2,086	$374	22	0	1,490
0	0.5	224	0.5	224	0.0	0	0.5	224	0.5	224	19	0	1,568	1,568	$281	17	0	1,120
0	0.5	298	0.5	298	0.0	0	0.5	298	0.5	298	25	0	2,086	2,086	$374	22	0	1,490
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
101	4.0	45	4.0	45	6.0	101	4.0	45	4.0	45	2	706	314	314	$70	1	504	224
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	137	53	53	$13	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
68	3.0	23	3.0	23	6.0	68	3.0	23	3.0	23	1	479	160	160	$40	1	342	114
68	3.0	23	3.0	23	6.0	68	3.0	23	3.0	23	1	479	160	160	$40	1	342	114
94	5.5	36	5.5	36	9.5	94	5.5	36	5.5	36	2	658	254	254	$61	1	470	182
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	11	6,132	1,680	1,680	$467	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	11	6,132	1,680	1,680	$467	0	0	0
80	5.5	31	5.5	31	9.5	80	5.5	31	5.5	31	1	559	216	216	$52	1	399	154
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
15	2.0	10	2.0	10	2.0	15	2.0	10	2.0	10	0	105	70	70	$14	0	75	50
55	5.5	407	5.5	407	9.5	1,055	5.5	407	5.5	407	19	7,382	2,849	2,849	$683	14	5,273	2,035
71	5.5	28	5.5	28	9.5	71	5.5	28	5.5	28	1	499	193	193	$46	1	356	138
34	5.5	13	5.5	13	9.5	34	5.5	13	5.5	13	1	239	92	92	$22	0	171	66
4	5.5	121	5.5	121	9.5	314	5.5	121	5.5	121	6	2,195	847	847	$203	4	1,568	605
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
3	0.5	2	0.5	2	0.5	3	0.5	2	0.5	2	0	20	13	13	$2	0	14	10
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
4	0.5	3	0.5	3	0.5	4	0.5	3	0.5	3	0	29	20	20	$3	0	21	14
1	0.5	8	0.5	8	0.5	11	0.5	8	0.5	8	0	79	53	53	$8	0	56	38
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0	0	$0	0	0	0
9		1,450		0		4,639		1,450		0	0	32,470	10,147	0	$1,668	0	23,193	7,248
4		2,214		3,054		1,384		2,214		3,054	147	9,688	15,498	21,378	$3,175	105	6,920	11,070
4		29,491		33,078		107,392		48,497		51,057	1,628	481,034	196,121	217,293	$49,082	1,83[illegible]	536,962	242,487
5		104,995		123,304		204,477		124,152		141,703	6,814	1,157,715	723,545	847,771	$166,024	5,5[illegible]4	1,022,386	620,762

Apr	103,060	Apr	121,300
May	104,930	May	123,270
Nov	106,995	Nov	125,341
	104,995		123,304

185,140	Jun	112,650	Jun	127,720
231,790	Jul	140,360	Jul	156,850
206,810	Aug	128,530	Aug	151,720
184,500	Sep	111,940	Sep	128,110
214,145	Oct	127,283	Oct	144,114
204,477		124,153		141,703

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ummer			Summer					
iter H/Yr.	On-Peak KWH/Yr.	Cost $	Demand kW/Yr.	Off-Peak KWH/Yr.	Inter KWH/Yr.	On-Peak KWH/Yr.	Cost $	No.
53	53	$13	0	0	0	0	$0	180
53	53	$13	0	0	0	0	$0	181
53	53	$13	0	0	0	0	$0	182
0	0	$0	0	0	0	0	$0	183
0	0	$0	0	0	0	0	$2	184
0	0	$0	0	0	0	0	$0	185
0	0	$0	0	0	0	0	$0	186
285	285	$68	1	527	204	204	$64	187
0	0	$1	0	0	0	0	$2	188
285	285	$68	1	527	204	204	$64	189
157	157	$31	1	168	112	112	$30	190
1,568	1,568	$336	7	2,520	1,120	1,120	$327	191
1,568	1,568	$281	17	0	1,120	1,120	$409	192
1,568	1,568	$281	17	0	1,120	1,120	$409	193
2,086	2,086	$374	22	0	1,490	1,490	$544	194
1,568	1,568	$281	17	0	1,120	1,120	$409	195
2,086	2,086	$374	22	0	1,490	1,490	$544	196
0	0	$0	0	0	0	0	$0	197
314	314	$70	1	504	224	224	$65	198
53	53	$13	0	0	0	0	$0	199
0	0	$0	0	0	0	0	$0	200
160	160	$40	1	342	114	114	$35	201
160	160	$40	1	342	114	114	$35	202
254	254	$61	1	470	182	182	$57	203
1,680	1,680	$467	0	0	0	0	$0	204
1,680	1,680	$467	0	0	0	0	$0	205
216	216	$52	1	399	154	154	$48	206
0	0	$0	0	0	0	0	$0	207
0	0	$0	0	0	0	0	$0	208
70	70	$14	0	75	50	50	$13	209
2,849	2,849	$683	14	5,273	2,035	2,035	$638	210
193	193	$46	1	356	138	138	$43	211
92	92	$22	0	171	66	66	$21	212
847	847	$203	4	1,568	605	605	$190	213
0	0	$0	0	0	0	0	$8	214
0	0	$0	0	0	0	0	$8	215
0	0	$0	0	0	0	0	$8	216
0	0	$0	0	0	0	0	$8	217
0	0	$0	0	0	0	0	$8	218
13	13	$2	0	14	10	10	$6	219
0	0	$0	0	0	0	0	$0	220
20	20	$3	0	21	14	14	$2	221
53	53	$8	0	56	38	38	$6	222
0	0	$0	0	0	0	0	$0	223
.147	0	$1,668	0	23,193	7,248	0	$1,129	224
.498	21,378	$3,175	105	6,920	11,070	15,270	$3,497	225
.121	217,293	$49,082	1,837	536,962	242,487	255,287	$76,873	226
.545	847,771	$166,024	5,574	1,022,386	620,762	708,514	$203,129	227

09-Mar-95

(3)

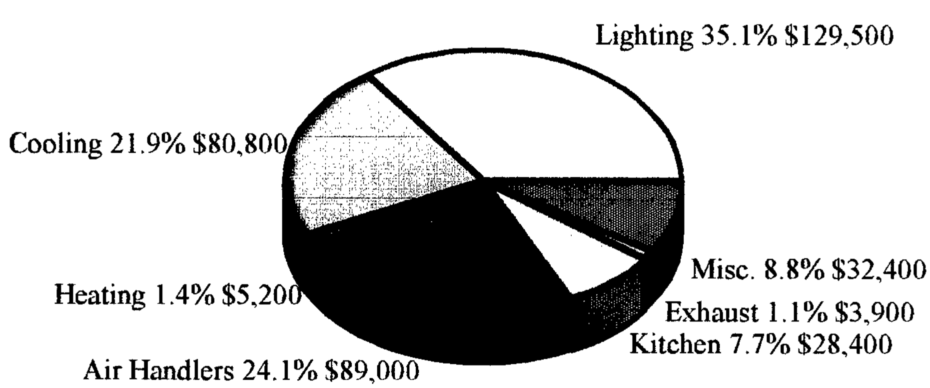
Table 5.3.2, Electric Model Summary

Area	*kW*	*kWh*	*Cost $*
Lighting	5,242	1,437,424	$129,500
Cooling	2,103	1,221,918	$80,800
Heating	148	90,020	$5,200
Air Handlers	2,396	1,475,202	$89,000
Kitchen	1,370	289,801	$28,400
Exhaust	107	63,898	$3,900
Miscellaneous	1,022	502,430	$32,400
Totals	12,388	5,080,693	$369,200

Figure 5.3.3 graphically represents the distribution of electricity costs by system or area. This graph shows lighting currently accounts for 35% of the total electric cost while cooling constitutes 22% and air handlers 24%.

Figure 5.3.3, Electric Model Results

Annual Cost Distribution



The high cost for cooling and air handling systems is due to winter operation of the chillers and operation of the air handler during unoccupied periods.

The electric model is balanced to 1993-94 electric billing history as presented in Section 4.2. This means electric usage and demand estimates for individual pieces of equipment inevitably total to billed quantities. The balancing is performed to insure overestimating of electric usage is not realized. Entech understands estimates for individual pieces of equipment cannot be 100% accurate. This is primarily due because Entech observes building operations for only a few days out of a year. Electric use of major pieces of equipment will be checked against EZDOE results later in this Section.

5.4 Space Heating (Heat Loss Model)

The heat loss model as described in Section 2.5.5 of this report, is shown on the following page in Table 5.4.1. The total annual Btu usage for space heating at Marshall Hall has been calculated to be 7,203 mmBtu per year, or 6,993 mcf of natural gas. Overall, as calculated by the heat loss model, space heating accounts for 55% (6,993 mcf ÷ 12,679 mcf) of the building natural gas consumption. Table 5.4.2 on the following page summarizes the heat loss model results.

HEAT LOSS CALCULATION
TABLE 5.4.1
MARSHALL HALL

		EXTERIOR DATA							VENTILATION, INFILTRATION INTERIOR DATA					BELOW GRADE			TOTAL
SPACE NAME		WALL HEIGHT FT	WALL LENGTH FT	WINDOW AREA SQ FT	DOOR AREA SQ FT	WALL AREA SQ FT	WALL U FAC	ROOF AREA SQ FT	CEILING HEIGHT FT	FLOOR AREA SQ FT	SPACE VOLUME CU FT	INF AIR CHANGE CFM	VENT AIR CFM	WALL HT FT	WALL LENGTH FT	FLOOR AREA SQ FT	HEAT LOSS BTU/HR
1ST FLOOR		14.0	1385	745	271	18,374	0.04	16,240	9.5	78,931	749,845	1,250	33,110	0	0	0	
	BTU/HR			22,946	19,729	45,274		63,661				75,584	2,002,493		0	0	2,229,686
	COST-$			$288	$248	$569		$800				$950	$25,159		$0	$0	$28,014
2ND LFOOR		14.0	1297	3,120	0	15,038	0.04	12,310	9.5	60,992	579,424	966	8,083	0	0	0	
	BTU/HR			96,096	0	37,054		48,255				58,406	488,860		0	0	728,671
	COST-$			$1,207	$0	$466		$606				$734	$6,142		$0	$0	$9,155
3RD FLOOR		14.0	1078	2,829	0	12,263	0.04	53,266	9.5	50,003	475,029	792	5,565	0	0	0	
	BTU/HR			87,133	0	30,216		208,803				47,883	336,571		0	0	710,606
	COST-$			$1,095	$0	$380		$2,623				$602	$4,229		$0	$0	$8,928
ATRIUM		8.0	1482	8,227	0	3,629	0.04	14,432	51.0	15,656	798,456	1,331	3,550	0	0	0	
	BTU/HR			253,392	0	8,942		56,573				80,484	214,704		0	0	614,095
	COST-$			$3,184	$0	$112		$711				$1,011	$2,698		$0	$0	$7,715
MECHANICAL SPACES		14.0	499	0	0	6,986	0.04	10,387	12.0	15,335	184,020	307	0	0	0	0	
	BTU/HR			0	0	15,649		40,717				18,549	0		0	0	74,915
	COST-$			$0	$0	$197		$512				$233	$0		$0	$0	$941
		0.0	0	0	0	0	0.00	0	0.0	0	0	0	0	0	0	0	
	BTU/HR			0	0	0		0				0	0		0	0	0
	COST-$			$0	$0	$0		$0				$0	$0		$0	$0	$0
		0.0	0	0	0	0	0.00	0	0.0	0	0	0	0	0	0	0	
	BTU/HR			0	0	0		0				0	0		0	0	0
	COST-$			$0	$0	$0		$0				$0	$0		$0	$0	$0
		0.0	0	0	0	0	0.00	0	0.0	0	0	0	0	0	0	0	
	BTU/HR			0	0	0		0				0	0		0	0	0
	COST-$			$0	$0	$0		$0				$0	$0		$0	$0	$0
		0.0	0	0	0	0	0.00	0	0.0	0	0	0	0	0	0	0	
	BTU/HR			0	0	0		0				0	0		0	0	0
	COST-$			$0	$0	$0		$0				$0	$0		$0	$0	$0
TOTALS			5,741	14,921	271	56,290		106,635		220,917	2,786,800	4,645	50,308		0	0	
	BTU/HR			459,567	19,729	137,134		418,009				280,907	3,042,628		0	0	4,357,973
	COST-$			$5,774	$248	$1,723		$5,252				$3,529	$38,227		$0	$0	$54,753

OUTSIDE TEMPERATURE (°F)	14
INSIDE TEMPERATURE (°F)	70
DELT TEMPERATURE (°F)	56
HEATING DEGREE DAYS/YR.	4,153
FUEL COST, $/UNIT	$7.83
HT VALUE, MMBTU/UNIT	1.03
SYSTEM EFFICIENCY (.XX)	70.0%
$/MMBTU (WITH EFF.)	$10.86

DOOR U FACTOR (BTU/SQFT*F*H)	1.3
WINDOW U FACTOR (BTU/SQFT*F*H)	0.55
ROOF U FACTOR (BTU/SQFT*F*H)	0.07
GRND FLOOR FACTOR (BTU/SQFT*H)	0.4
GRND WALL FACTOR (BTU/SQFT*H)	0.4
ANNUAL COST FACTOR ($/YR/BTU/HR)	0.012564
C (D)	0.65

WIND VELOCITY (MPH)	15
INFILTRATION AIR CHANGES/HR	0.1
INFILTRATION AIR CHANGE FACTOR	0.0016667
WINTER GRND WATER TEMP (°F)	50
GROUND TEMP DELTA TEMP (°F)	20
GROUND WALL FACTOR	0.3
BELOW GRADE DELT TEMP (ADJU USTED)	6
GROUND FLOOR FACTOR	1.995

HEAT LOSS, MMBTU/YR	7,203
HEAT LOSS,BTU/DEG DAY	1,734,295
UNITS FUEL/DEG DAY	1.68
UNITS FUEL/YR	6,993
COST, $/SF/YR	$0.25
COST, $/CF/YR	$0.0196
BTU/HR/S	20

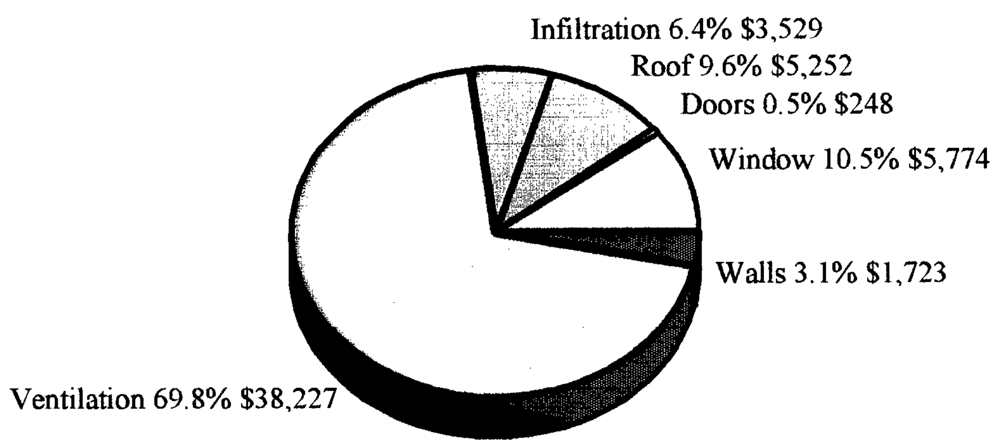
Table 5.4.2, Heat Loss Model Results

Area	*Loss, Btuh*	*Gas, mcf*	*Cost $*
Windows	459,567	738	$5,774
Doors	19,729	32	$248
Walls	137,134	220	$1,723
Roof	418,009	671	$5,252
Infiltration	280,907	451	$3,529
Ventilation	3,042,627	4,882	$38,227
Below Grade	0	0	$0
Totals	4,357,973	6,994	$54,753

The above table indicates the design day heat loss is approximately 4,400 mBh. The existing boilers are rated at a combined capacity of approximately 5,000 mBh. Figure 5.4.3 below graphically displays the heat loss model results.

Figure 5.4.3 Heat Loss Model Results

Annual Cost Distribution



Typical of many buildings, Figure 5.4.3 indicates that ventilation loads constitute most of the building heating load. The estimates will be compared to EZDOE results later in this Section.

5.5 Domestic Water Heating

The major user of domestic hot water at Marshall Hall is food preparation. Currently Marshall Hall serves an average of 300 meals per day during the course of a year. Based upon ASHRAE hot water requirements of 2.4 gallons/meal, the annual energy consumption for kitchen domestic hot water is as follows:

$$Kitchen\ dhw \cong \frac{300\frac{meals}{day} \times 260\frac{days}{year} \times 2.4\frac{gallons}{meal} \times 8.3\frac{lbs}{lb} \times (140°F - 50°F)}{1{,}000{,}000\frac{Btu}{mmBtu} \times .8} \cong 174.8 mmBtu/yr$$

In addition, there is usage of domestic hot water for showers at an exercise room and general use in bathrooms and cleaning. Calculations for these areas are as follows:

$$Showers \cong \frac{40\frac{people}{day} \times 260\frac{days}{year} \times 10\frac{gallons}{person} \times 8.3\frac{lbs}{gal} \times (140°F - 50°F)}{1{,}000{,}000\frac{Btu}{mmBtu} \times .8} \cong 97.1 mmBtu/yr$$

$$General \cong \frac{300\frac{people}{day} \times 260\frac{days}{year} \times 0.5\frac{gallons}{person} \times 8.3\frac{lbs}{gal} \times (140°F - 50°F)}{1{,}000{,}000\frac{Btu}{mmBtu} \times .8} \cong 36.4 mmBtu/y$$

Table 5.5.1 summarizes the results of the above calculations.

Table 5.5.1, DHW Summary

Period	*Energy, mmBtu*	*Gas, mcf*	*Gas, Cost*
Kitchen	175	170	$1,330
Showers	97	94	$736
General	36	35	$282

5.6 Reheating (Cooling Season)

Each air handling system contains spaces which use reheating of supply air. Most of the spaces primarily located around the perimeter of the building. From drawings design and documents approximately 90,000 cfm of air is treated by reheats. Of this quantity, approximately 10,000 cfm is constant volume while the remaining 80,000 cfm can be throttled back to 30%. This air generally enters a vav box at 55°F where it is heated by a coil to provide the proper space temperatures. The temperature rise in the air stream can be from 0°F to 15°F depending upon internal loads. For the most part, it is expected that only the areas with constant volume are using reheats during the cooling season. It is further expected that the average temperature rise in the air stream is 10°F. Based upon these estimates, the annual reheat energy is estimated at 194 mmBtu or 269 mcf (194 mmBtu ÷ 1.03 mmBtu/mcf ÷ 70% eff.) calculated as follows:

$$Reheat\ Energy \cong \frac{10{,}000 cfm \times 1.08 \times 5\,^{\circ}F\Delta T \times 24\frac{hrs}{day} \times 30\frac{days}{mo} \times 5\frac{mo}{yr}}{1{,}000{,}000\frac{Btu}{mmBtu}} \cong 194 mmBtu$$

The quantity calculated above will be checked using the DOE simulation program as described in Section 2.

5.7 Humidification (Heating Season)

Currently air handlers 1S through 9 utilize steam humidification. A total of 785 lbs of humidification is installed, taking care of approximately 48,500 cfm of minimum outside air. According to design documents, during the winter most spaces are kept at approximately 30% R.H. During 1993-94, the air handling systems operated 16 hours per day. Using an average outdoor winter temperature of 40°F and a relative humidity of 60%, (Reference Attachment 10.3) the annual gas usage for humidification is 903 mcf. The following calculations show the process used to determine gas usage:

Indoor Winter Temperature	=	70°F
Indoor Winter R.H.	=	30%
Moisture Content at Saturation	=	8.10 grains
Moisture Content at 70% R.H.	=	2.43 grains (8.10 gr x 30%)

Average Winter Temperature	=	40°F
Average Winter Relative R.H.	=	60%
Moisture Content at Saturation	=	2.86 grains
Moisture Content at 70% R.H.	=	1.72 grains (2.86 gr x 60%)

Average lbs/hr (Steam)	=	179 lbs/hr [(2.43 gr - 1.72 gr) x (48,500 cfm x 60 min/hr) ÷ 7,000 gr/lbs = 295 lbs/hr]
Equivalent Gas (mcf/yr)	=	903 mcf [(295 lbs/hr x 16 hrs/day x 30 days/mo x 4 mo) x 1,150 Btu/lb ÷ 1,030,000 Btu/mcf ÷ 70% eff = 903 mcf]

5.8 Kitchen Energy (gas)

Currently Marshall Hall contains a variety of gas cooking equipment. Table 5.8.1 on the following page displays estimated energy consumption for the various pieces of equipment. This table was developed from Entech's observations during walk-through and represents a five-day per week operation, producing breakfast and lunch. Gas usage for direct-fired gas equipment is based upon an average efficiency of 65%.

Table 5.8.1, Kitchen Gas Users

Description	*Btu/hr*	*Quantity*	*hrs/day*	*days/yr*	*mmBtu/yr*	*mcf/yr*
Convection Oven	100,000	1	4	260	104.0	155
Convection Steamer	200,000	1	4	260	208.0	311
Fryer	100,000	1	4	260	104.0	155
Range/Oven	130,000	2	4	260	270.4	404
Broiler	40,000	2	4	260	83.2	124
Totals					769.6	1,150

The above table indicates that total gas consumed by direct fired gas equipment is 1,150 mcf per year for a cost of $13,300 (1,150 mcf/yr x $7.83/mcf).

5.9 DOE Simulation Results

A DOE simulation was performed as described in Section 2 for Marshall Hall. Simulation input/output information can be located in Attachment 10.7. A summary of its results and a comparison to estimates developed earlier in this report is presented below in Table 5.9.1. It should be noted that simulation programs are based upon historical weather data and cannot account for significant changes in weather patterns. The results of DOE will be used to check previous estimates.

Table 5.9.1, DOE Simulation Results and Comparisons

Area	*DOE kWh*	*DOE mcf*	*Entech kWh*	*Entech mcf*
Air Handlers/Exhaust	1,225,142		1,539,100	
Cooling	1,078,708		1,221,918	
Heating/Humidification	81,855	7,397	90,020	7,896
Reheats				269
DHW				299
Lighting	1,623,167		1,437,424	
Misc./Kitchen	637,454		784,962	1,150

The above table indicates that both methods provide similar results. It should be noted that EZDOE is used as a backup tool. EZDOE calculations are based upon historical weather data which cannot reflect changes in weather.

5.10 Gas Balance

The total natural gas which can be accounted for is 9,614 mcf. This quantity is based on the estimates presented throughout this Section. The natural gas billing history shows a total of 12,678 mcf billed during 1993-94. This indicates that 3,064 mcf (12,678 mcf - 9,614 mcf) is unaccounted for. From walk-through and information provided by maintenance personnel, it was found that the boilers have been cycling constantly and operation has been inefficient. Based upon the existing operation of the boilers and the conservative calculations provided throughout this section, Entech believes the unaccounted gas is due to boiler inefficiencies. For the purposes of this study, the 3,064 mcf and $24,000 (3,064 mcf x 7.83/mcf) will be labeled as boiler losses. Table 5.10.1 displays gas consumption distribution. It should be realized that values in this table balance to building gas usage.

Table 5.10.1, Gas Balance

Area	*mcf*	*$*
Kitchen	1,150	$9,000
DHW	299	$2,300
Humidification	903	$7,100
Reheats	269	$2,100
Heating	6,993	$54,800
Losses	3,064	$24,000
Totals	12,678	$99,300

5.11 Summary

Table 5.11.1 summarizes the energy estimates developed throughout Section 5.0. The quantities show are based on Entech's estimates.

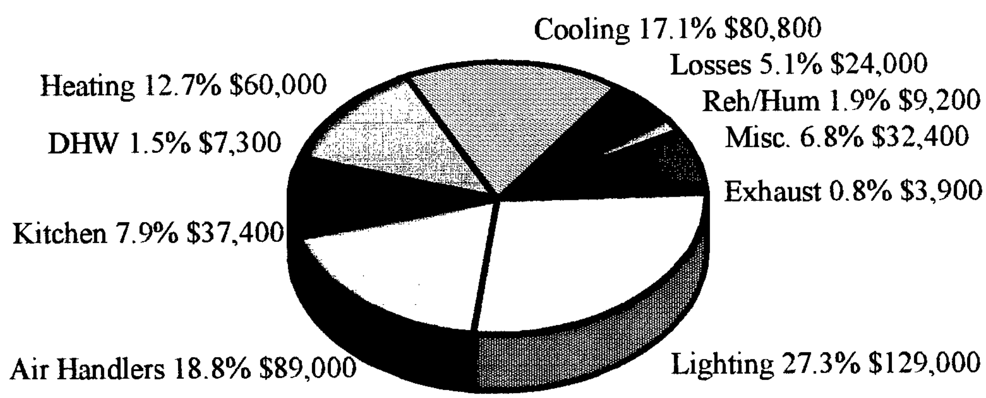
Table 5.11.1, Energy Cost by System/Area

Description	*Total $*	*Electric $*	*Gas $*
Cooling	$80,800	$80,800	$0
Heating	$60,000	$5,200	$54,800
DHW	$2,300	$0	$2,300
Kitchen	$37,400	$28,400	$9,000
Air Handlers	$89,000	$89,000	$0
Lighting	$129,500	$129,500	$0
Exhaust	$3,900	$3,900	$0
Miscellaneous	$32,400	$32,400	$0
Reheating	$2,100	$0	$2,100
Humidification	$7,100	$0	$7,100
Boiler Losses	$24,000	$0	$24,000
Totals	$468,500	$369,200	$99,300

Figure 5.11.2 below graphically illustrates the results from Table 5.11.1.

Figure 5.11.2

Energy Cost by System/Area



6.0 ENERGY CONSERVATION OPPORTUNITIES

6.1 General

The items discussed in this section of the report are the result of investigation of several energy cost reduction strategies and products. The items which appear to offer the most significant savings are presented herein and are called Energy Conservation Opportunities (ECOs). The format for an ECO addresses the following:

Existing discusses the current operational levels and approximate costs.

Proposed presents a new concept designed to save energy; however, it should be understood that the actual design has not yet been performed. Arrangements and quantities may change somewhat during final design.

Construction Costs covers materials, labor, and indirect costs needed for a complete project, including associated engineering design and construction management costs. Escalation is not included. Costs are in 1995 dollars.

Savings shows an expected level of annual cost savings does not include price increases of various energy sources or interactive savings. The ECOs are calculated on a stand alone basis.

Discussion notes simple payback period and additional monetary or operation factors involved in the ECO.

6.2 Recommended ECOs

The following ECOs have a payback period of under 10 years and are therefore recommended for implementation.

ECO #	*ECO Description*
1	Reducing Boiler Cycling (Nov-Apr)
2	Expand Energy Monitoring and Control System
3	Shut off Boiler in Summer
4	Security Room AC Renovations
4A	Shutdown Chillers During Winter & Summer Unoccupied Periods
5	Electric Cooking Equipment to Natural Gas
6	Reduce Building HVAC Outdoor Air Requirements
7	Replace Electric Dishwasher Booster Heater
8	100 Watt HPS Loading Dock Luminaires
9	4' T-8 Lamp Retrofit
10	Reflectors
11	3' HPS Bollards
12	Replace 75 Watt Mercury Vapor Wall Washers
13	Motion Sensors
14	Exit Signs to LED

ECO-1
Reduce Boiler Cycling (Nov-Apr)

Existing. The current space heating system was designed for ASHRAE outdoor winter design conditions. During periods of light space heating, the system has difficulty following building loads smoothly and efficiently. Both the steam converter control valve and the boiler cycle from completely open to completely shut several times, (10 to 30), per hour. This cycling causes the boiler to operate at a system efficiency significantly below its optimum.

Fuel consumption patterns and the heat loss model indicate the overall boiler system efficiency at approximately 50% (calculated in Section 5.10) during these periods. As shown below, 10,007 mcf is used from November through April by the boilers. This quantity includes 2,111 mcf which is lost due to the cycling. Annual gas cost for the boilers during this period is $78,400. The table below summarizes boiler gas usage:

Area	mcf	$
Heating	6,993	$54,800
Humidification	903	$7,100
Reheats	0	$0
Losses	2,111	$16,500
Totals	10,007	$78,400

Gas Usage = 10,007 mcf
Gas Cost = $78,400 (10,007 mcf x $7.83/mcf= $78,355, use $78,400)

Proposed. Replace the current steam control valve arrangement with two new valves piped in parallel. The smaller valve (one third size) will modulate alone during periods of low demand and will restrict boiler operation to a more steady level. During colder weather, the second control valve will modulate once the first valve is fully open to meet peak loads. Overall boiler efficiency is expected to increase substantially. Entech expects that approximately 80% of the losses (shown above) will be avoided which would provide an overall system efficiency of 65%. The system efficiency would be comparable to typical seasonal efficiencies for well operated systems. Annual fuel usage for the boilers during November through April will be reduced to 8,318 mcf while gas cost will be reduced to $65,100.

Area	mcf	$
Heating	6,993	$54,800
Humidification	903	$7,100
Reheats	0	$0
Losses	422	$3,300
Totals	8,318	$65,100

Gas Usage = 8,318 mcf (10,007 mcf - 2,111 mcf x 80%)

Gas Cost = $65,100 (8,318 mcf x $7.83/mcf = $65,130, use $65,100)

Construction Cost. The expected construction cost for this project will be $9,000. (reference attached cost estimate).

Material	$4,000
Labor	$4,000
Engineering	$1,000

Savings. The annual cost savings resulting from the implementation of this project will be $13,300 ($78,400 - $65,100).

Gas Usage = 1,689 mcf (10,007 mcf - 8,318 mcf)

Energy Usage = 1,740 mmBtu (1,689 mcf x 1,030,000 Btu/mcf) ÷ 1,000,000 Btu/mmBtu)

Btu/sf	=	7,146 Btu/sf (1,689 mcf x 1,030,000 Btu/mcf) ÷ 243,450 sf)

Discussion. The expected payback resulting from the implementation of this project is 0.7 years (\$9,000÷\$13,300). There will be no additional monetary savings due to reduced maintenance.

ECO - 1
REDUCE BOILER CYCLING

#	DESCRIPTION	QUAN.	UNITS	MATERIAL $/UNIT	MATERIAL TOTAL	LABOR $/UNIT	LABOR TOTAL	LINE TOTAL	#
1	MECHANICAL								1
2	CONTROL VALVES	1	LS	$1,000	$1,000	$1,000	$1,000	$2,000	2
3	PIPE & ACCESSORIES	1	LS	$2,400	$2,400	$1,500	$1,500	$3,900	3
4	DEMOLITION	1	LS		$0	$700	$700	$700	4
5					$0		$0	$0	5
6					$0		$0	$0	6
7					$0		$0	$0	7
8					$0		$0	$0	8
9					$0		$0	$0	9
10					$0		$0	$0	10
11					$0		$0	$0	11
12					$0		$0	$0	12
13					$0		$0	$0	13
14					$0		$0	$0	14
15					$0		$0	$0	15
16					$0		$0	$0	16
17					$0		$0	$0	17
18					$0		$0	$0	18
19					$0		$0	$0	19
20					$0		$0	$0	20
21					$0		$0	$0	21
22					$0		$0	$0	22
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25					$0		$0	$0	25
26					$0		$0	$0	26
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30					$0		$0	$0	30
31					$0		$0	$0	31
32					$0		$0	$0	32
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44					$0		$0	$0	44
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47					$0		$0	$0	47
48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53					$0		$0	$0	53
54					$0		$0	$0	54
55	CONTINGENCY 20%				$580		$840	$1,420	55
56					$0		$0	$0	56
57									57
	TOTALS>>>>>>>>				**$4,000**		**$4,000**	**$8,000**	

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ENTECH ENGINEERING INC.
24-Aug-95

ECO-2
Expand Energy Monitoring and Control System

Existing. Marshall Hall has an existing Energy Monitoring and Control System (EMCS). This system was originally specified during the design phase and subsequently installed during construction. According to design documents, the system has the capability of controlling the following HVAC areas

1	Air Handling Units
2	Chillers
3	Boilers

These areas can be controlled by the use of schedules, start-stops, temperature resets and enthalpy control. The existing energy usage and cost for these areas as calculated in the Electric Model and Heat Loss Model is summarized below and shown in detail on the following pages. The existing annual cost for the above mentioned areas is $197,800.

Air Handler Usage

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	1,313	468,114	172,074	172,074	$43,021
Summer	937	334,368	122,910	122,910	$40,779
Totals	2,250	802,482	294,984	294,984	$83,800

Boiler Usage

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	93	29,014	11,198	11,198	$2,796
Summer	32	12,038	4,725	4,950	$1,485
Totals	125	41,052	15,923	16,148	$4,300

Boiler Gas Usage = 6,993 mcf (space heating energy)

Boiler Gas Cost = $54,800 (6,993 mcf x $7.83/mcf = $54,755 use $54,800)

Chiller Usage

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	476	149,057	52,224	76,563	$15,117
Summer	955	272,294	123,193	135,406	$39,764
Totals	1,431	421,351	175,417	211,969	$54,900

Proposed. The EMCS is not being utilized to the full extent of its capabilities. The EMCS needs reprogramming and "tuning". A Robertshaw Control Company representative should be retained to accomplish required programming, tuning, consultation, and system operations training for Building Operating Engineers. The potential exists for energy and cost savings thru implementation of the following control strategies:

Utilize the Automatic Economizer Cycle. Utilize the program's economizer cycle to optimize performance; currently, the economizers are operated manually. Allow air handling units to utilize outdoor air economizer cycle at all times. This will reduce chiller operation and boiler operation. All control points exist. There are no savings expected for this item since it is impossible to predict currently, how the economizers are utilized throughout the year.

Shut Off Air Handling Units in Unoccupied Periods. Program all non-critical air handling units to shut off during unoccupied hours. This will reduce chiller and boiler operation. Chiller energy savings have been accounted for in ECO-7. The boiler gas savings will be calculated in this ECO as they are not included in any other ECO. Currently the air handling units have control points tied to the EMCS.

Presently, all air handling units operate during the off-peak hours. In the electric model during this period the units shown operating 8.5 full load equivalent hours. Since the building is unoccupied during the off-peak hours, it is unnecessary to operate the fans. It is estimated that scheduling can reduce off-peak operation by 6 hours. The remaining 2 hours of operation will be for fan cycling. The electric model has been revised to show this change which has resulted in electric usage for the air handlers being reduced to 606,237 kWh. There will be no reduction in electric demand for the fans. Electric cost for the fans will be reduced to $54,500 as summarized on the below and shown in detail on attached tables.

Air Handler Usage

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	1,313	93,753	105,000	172,074	$26,085
Summer	937	37,500	75,000	122,910	$28,434
Totals	2,250	131,253	180,000	294,984	$54,500

<u>Reduce Boiler Usage at Night (Nov-Apr)</u>. Program the boilers to setback during the unoccupied hours by reducing the amount of outside air introduced to the building. Reduction in nighttime ventilation will significantly reduce boiler operation. Boiler savings are only for the months of November through April. Savings during the summer months will be accounted for in ECO-3.

Electric usage for the boilers and pumps will be reduced but not eliminated. The boilers will still need to operate in order to offset building skin losses. Entech estimates 2 full load hours of operation by the boiler system will be saved. A revised electric model boiler energy cost lowered to $3,900 as shown on the following page.

Boiler Usage

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	93	21,603	10,180	11,198	$2,475
Summer	32	10,688	3,750	4,950	$1,393
Totals	125	32,291	13,930	16,148	$3,900

The heating load associated with the outdoor air is 3,042,600 But/hr as is calculated in the Heat Loss Model and the associated cost is $38,200 or 4,879 mcf. Unoccupied hours account for 60% of the total operating hours available. By closing the outdoor air dampers in the unoccupied hours, the associated heat load is reduced to 1,217,000 Btu/hr with a new cost of $15,300.

Boiler Gas Usage = 1,952 mcf (4,879 mcf x (1 - .6) = 1,952 mcf)

Boiler Gas Cost = $15,300 (1,952 mcf x $7.83/mcf = $15,284, use $15,300)

Chilled Water Reset. Program the chillers to allow the chilled water supply temperature to air handling unit cooling coils to rise. Chiller will optimize chilled water supply temperature based on return water temperature while satisfying all building systems space temperature and humidity requirements. This will reduce chiller energy usage. The points to reset chilled water by the EMCS exist as well as programming. Savings for this item are included below.

Raise Summer Space Temperatures. Program all non-critical air handling unit systems to allow for higher space temperatures during the cooling season. The space temperatures are currently set for 70°F in the summer. Current energy standards recommend 78°F; raise summer space temperature to 75° for all non-critical spaces. By raising the space temperature, the leaving air temperature of the corresponding air handlers can be raised and the space humidity levels can also be raised in the same areas. The discharge air set points will vary with each unit. Space humidity levels can be raised from 50% to 55 %. These changes will reduce chilled water system energy usage. All control points currently exist in the EMCS to make the change and must be re-programmed.

The current energy electric cost for operating of the chiller to produce chilled water is $55,300. The DOE simulation program was recalculated with a summer space temperature setting of 75°F. DOE calculated an 11% decrease in the quantity of cooling energy required. For the purposes of this study, the 11% reduction in summer demand and usage will lower annual chiller cost to $50,500.

Chiller Usage

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	476	149,057	52,224	76,563	$15,117
Summer	850	242,342	109,642	120,511	$35,391
Totals	1,326	391,399	161,866	197,074	$50,500

Lower Winter Space Temperatures. Program all non-critical air handling unit systems to allow for lower space temperatures during the heating season. The space temperatures are currently set for 70°F in the winter. Current energy standard recommend 68°F. Lowering winter space temperature to 68°F for all non-critical spaces. DOE was also recalculated at this lower temperature during the heating season. DOE calculated a 3% decrease in winter space heating This change will reduce boiler operation. All control points currently exist in the EMCS to make the change and must be re-programmed.

As shown in existing operation, the quantity of gas used for space heating is 6,993 mcf and $54,800. It will be assumed that "reducing boiler operation at night" will be implemented.

Therefore energy savings will be based on a revised gas usage of 4,066 mcf (6,993 mcf - (4,879 mcf - 1,952 mcf)). Energy usage for space heating will be lowered to 3,944 mcf (4,066 mcf x 97%). Overall space heating cost will be lowered to $30,900 (3,944 mcf x $7.83/mcf).

Automatic Boiler and Chiller Control and Sequencing. Program boilers and chiller to operate automatically under the EMCS control. Program boilers and chillers to sequence to satisfy load demand with minimum energy input. All control points exist.

Annual cost for these systems will be reduced to $139,800 ($54,500 + $3,900 + $30,900 + $50,500).

Construction Cost. The expected construction cost for this project will be $50,000. (Reference attached cost estimate).

Material	$ 5,000
Labor	$40,000
Engineering	$ 5,000

Savings. The annual cost savings resulting from the implementation of this project will be $58,000 ($197,800 - $139,800).

Off-Peak kWh	=	709,942 kWh (1,264,885 kWh - 554,943 kWh)
Intermediate kWh	=	130,528 kWh (486,324 kWh - 355,796 kWh)
On-Peak kWh	=	14,895 kWh (523,101 kWh - 508,206 kWh)
Summer kW	=	105 kW (1,924 kW - 1,819 kW)
Non-Summer kW	=	0 kW (1,882 kW - 1,882 kW)
Gas Usage	=	3,049 mcf (6,993 mcf - 3,944 mcf)

Energy Usage	=	6,060 mmBtu [((709,942 kWh + 130,528 kWh + 14,895 kWh) x 3,413 Btu/kWh) + (3,049 mcf x 1,030,000 Btu/mcf)] ÷ 1,000,000 Btu/mmBtu
Btu/sf	=	24,891 Btu/sf [((709,942 kWh + 130,528 kWh + 14,895 kWh) x 3,413 Btu/kWh) + (3,049 mcf x 1,030,000 Btu/mcf)] ÷ 243,450 sf

Discussion. The expected payback resulting from the implementation of this project is 0.9 years ($50,000 ÷ $58,000). The existing EMCS is capable of adequately controlling the building. The system is not being utilized currently because operating personnel are not trained on how to operate the system. This ECO is recommended for its low payback and to get operating personnel trained. Once operating personnel are trained, the re-programming of most of the points can be done by them and save on outside control contractor re-programming costs. Recommend that the first step to implementing this ECO is to have operating personnel trained. There will be no additional monetary savings due to reduced maintenance.

ECO-2
EXISTING ENERGY USAGE TABLE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
BOILERS	15	4	5,501	2,123	2,123	1,350	600	825
HW PUMPS	78	28	23,513	9,075	9,075	10,688	4,125	4,125
AHU SUPPLY FANS (9)	893	638	318,141	116,837	116,837	227,244	83,455	83,455
AHU RETURN FANS (9)	420	299	149,973	55,237	55,237	107,124	39,455	39,455
TOTALS	1,406	969	497,128	183,272	183,272	346,406	127,635	127,860

Electric Cost = $88,100

Non- Summer:

KW	$9,280	1,406 kw/yr * $6.60/kw
Off-peak KWH	$18,394	497,128 kwh/yr * $0.037/kwh
Intermediate KWH	$8,431	183,272 kwh/yr * $0.046/kwh
On- peak KWH	$9,713	183,272 kwh/yr * $0.053/kwh

Summer:

KW	$16,560	969 kw/yr * $17.09/kw
Off-peak KWH	$11,778	346,406 kwh/yr * $0.034/kwh
Intermediate KWH	$5,999	127,635 kwh/yr * $0.047/kwh
On- peak KWH	$7,927	127,860 kwh/yr * $0.062/kwh

Totals $88,081

ECO-2
PROPOSED ENERGY USAGE TABLE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
BOILERS	15	4	4,053	1,930	2,123	450	300	825
HW PUMPS	78	28	17,550	8,250	9,075	9,000	3,750	4,125
AHU SUPPLY FANS (9)	893	638	63,789	71,442	116,837	25,515	51,030	83,455
AHU RETURN FANS (9)	420	299	29,964	33,558	55,237	11,985	23,970	39,455
TOTALS	1,406	969	115,356	115,180	183,272	46,950	79,050	127,860

Electric Cost = $58,400

Non- Summer:

KW	$9,280	1,406 kw/yr * $6.60/kw
Off-peak KWH	$4,268	115,356 kwh/yr * $0.037/kwh
Intermediate KWH	$5,298	115,180 kwh/yr * $0.046/kwh
On- peak KWH	$9,713	183,272 kwh/yr * $0.053/kwh

Summer:

KW	$16,560	969 kw/yr * $17.09/kw
Off-peak KWH	$1,596	46,950 kwh/yr * $0.034/kwh
Intermediate KWH	$3,715	79,050 kwh/yr * $0.047/kwh
On- peak KWH	$7,927	127,860 kwh/yr * $0.062/kwh

Totals $58,359

ECO - 2
EXPAND ENERGY MONITORING AND CONTROLS SYSTEM

#	DESCRIPTION	QUAN.	UNITS	MATERIAL		LABOR		LINE TOTAL	#
				$/UNIT	TOTAL	$/UNIT	TOTAL		
1									1
2	REPROGRAMMING OF POINTS	125	EA	$0	$0	$200	$25,000	$25,000	2
3	ADDITIONAL POINTS	4	PT	$1,250	$5,000	$1,000	$4,000	$9,000	3
4	TRAINING OF OPERATING PERSONEL	1	EA		$0	$6,000	$6,000	$6,000	4
5					$0		$0	$0	5
6					$0		$0	$0	6
7					$0		$0	$0	7
8					$0		$0	$0	8
9					$0		$0	$0	9
10					$0		$0	$0	10
11					$0		$0	$0	11
12					$0		$0	$0	12
13					$0		$0	$0	13
14					$0		$0	$0	14
15					$0		$0	$0	15
16					$0		$0	$0	16
17					$0		$0	$0	17
18					$0		$0	$0	18
19					$0		$0	$0	19
20					$0		$0	$0	20
21					$0		$0	$0	21
22					$0		$0	$0	22
23					$0		$0	$0	23
24					$0		$0	$0	24
25					$0		$0	$0	25
26					$0		$0	$0	26
27					$0		$0	$0	27
28					$0		$0	$0	28
29					$0		$0	$0	29
30					$0		$0	$0	30
31					$0		$0	$0	31
32					$0		$0	$0	32
33					$0		$0	$0	33
34					$0		$0	$0	34
35					$0		$0	$0	35
36					$0		$0	$0	36
37					$0		$0	$0	37
38					$0		$0	$0	38
39					$0		$0	$0	39
40					$0		$0	$0	40
41					$0		$0	$0	41
42					$0		$0	$0	42
43					$0		$0	$0	43
44					$0		$0	$0	44
45					$0		$0	$0	45
46					$0		$0	$0	46
47					$0		$0	$0	47
48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53					$0		$0	$0	53
54					$0		$0	$0	54
55					$0		$0	$0	55
56									56
	TOTALS>>>>>>>>				**$5,000**		**$35,000**	**$40,000**	

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ENTECH ENGINEERING INC.

24-Aug-95

ECO-3
Shut Off Boilers in Summer

Existing. During the non-space heating months from May through September, the boilers have been operational in order to provide hot water to reheat coils. Total cost to operate the boilers and pumps in the non-space heating months is $11,400. The costs and usages are developed from billing histories and electric models.

Gas Usage	=	1,222 mcf
Gas Cost	=	$9,600 (1,222 mcf x $7.83/mcf = $9,568, use $9,600)
Off-Peak kWh	=	14,648 kWh
Intermediate kWh	=	5,685 kWh
On-Peak kWh	=	5,910 kWh
Summer kW	=	37 kWh
Electric Cost	=	$1,800 (37 kW/yr x 17.09/kW + 14,648 kWh x $0.034/kWh + 5,685 kWh x $0.047/kWh + 5,910 kWh x $0.062/kWh = $1,764, use $1,800)

Refer to the attached Existing Energy Usage Table for a more detailed breakdown of operating costs.

Proposed. Shut off the boilers during the months of May through September. Allow the VAV system boxes to modulate space temperatures without the use of the reheats. The minimum supply cfm set point and controllers must be modified for approximately 125 VAV control boxes. The minimum set points will be reduced form 30% to 15% of the maximum supply air quantity. The reduction in supply cfm will still meet ASHRAE minimum ventilation rates. During the summer period, the need to operate the boilers will be eliminated. Therefore, all gas and electric usage by the boilers during the summer months will be $0.

Gas Usage	=	0 mcf
Gas Cost	=	$0
Off-Peak kWh	=	0 kWh
Intermediate kWh	=	0 kWh
On-Peak kWh	=	0 kWh
Summer kW	=	0 kW

Refer to the attached Proposed Energy Usage Table for a more detailed breakdown of operating costs.

Construction Cost

The expected construction cost for this project is $14,000 (reference attached cost estimate).

Material	$ 1,000
Labor	$ 13,000
Engineering	$ 0

Savings.

The annual cost savings resulting from the implementation of this project will be $11,400 ($11,400 - $0).

Gas Usage	=	1,222 mcf (1,222 mcf - 0 mcf)
Gas Cost	=	$9,600 (1,222 mcf x $7.83/mcf= $9,568)
Off-Peak kWh	=	14,648 kWh (14,648 kWh - 0 kWh)
Intermediate kWh	=	5,685 kWh (5,685 kWh - 0 kWh)
On-Peak kWh	=	5,910 kWh (5,910 kWh - 0 kWh)

Summer kW	=	37 kW (37 kW - 0 kW)
Energy Usage	=	1,348 mmBtu [(14,648 kWh + 5,685 kWh + 5,910 kWh) x 3,413 Btu/kWh + (1,222 mcf x 1,030,000 Btu/mcf)] ÷ 1,000,000 Btu/mmBtu
Energy Usage	=	5,538 Btu/sf [(14,648 kWh + 5,685 kWh + 5,910 kWh) x 3,413 Btu/kWh + (1,222 mcf x 1,030,000 Btu/mcf)] ÷ 243,450 sf

Discussion. The expected payback resulting from the implementation of this project is 1.2 years ($14,000÷$11,400). There is no additional monetary savings due to reduced maintenance.

ECO - 3
EXISTING ENERGY USAGE TABLE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
BOILER B-2	1	4	360	60	60	1,350	600	825
PUMP P-2	4	28	2,250	900	900	10,688	4,125	4,125
TOTALS	5	32	2,610	960	960	12,038	4,725	4,950

Electric Cost = $1,700

Non- Summer:		
KW	$32	5 kw/yr * $6.60/kw
Off-peak KWH	$97	2,610 kwh/yr * $0.037/kwh
Intermediate KWH	$44	960 kwh/yr * $0.046/kwh
On- peak KWH	$51	960 kwh/yr * $0.053/kwh
Summer:		
KW	$547	32 kw/yr * $17.09/kw
Off-peak KWH	$409	12,038 kwh/yr * $0.034/kwh
Intermediate KWH	$222	4,725 kwh/yr * $0.047/kwh
On- peak KWH	$307	4,950 kwh/yr * $0.062/kwh
Totals	$1,709	

ECO - 3
PROPOSED ENERGY USAGE TABLE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
BOILER B-2	0	0	0	0	0	0	0	0
PUMP P-2	0	0	0	0	0	0	0	0
TOTALS	0	0	0	0	0	0	0	0

Electric Cost =		$0	
Non- Summer:			
	KW	$0	0 kw/yr * $6.60/kw
	Off-peak KWH	$0	0 kwh/yr * $0.037/kwh
	Intermediate KWH	$0	0 kwh/yr * $0.046/kwh
	On- peak KWH	$0	0 kwh/yr * $0.053/kwh
Summer:			
	KW	$0	0 kw/yr * $17.09/kw
	Off-peak KWH	$0	0 kwh/yr * $0.034/kwh
	Intermediate KWH	$0	0 kwh/yr * $0.047/kwh
	On- peak KWH	$0	0 kwh/yr * $0.062/kwh
	Totals	$0	

ECO - 3
SHUT OFF BOILERS IN SUMMER

				MATERIAL		LABOR		LINE	
#	DESCRIPTION	QUAN.	UNITS	$/UNIT	TOTAL	$/UNIT	TOTAL	TOTAL	#
	MECHANICAL								1
1	ALTER VAV BOXES	125	EA	$10	$1,250	$100	$12,500	$13,750	2
2									3
3									4
4									5
5									6
6									7
7									8
8									9
9									10
10									11
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56									57
57	**TOTALS>>>>>>>>**				**$1,000**		**$13,000**	**$14,000**	58

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ENTECH ENGINEERING INC. 24-Aug-95

ECO-4
Security Room AC Renovations

Existing. According to design drawings, Room 1A129, located on the first floor, is designated as the security Room while Room 1A132 (adjacent) is designated as telephones. Air conditioning for the telephone room is supplied by air handling unit AHU-3. An independent fan coil unit, FC-5, furnishes air conditioning for the security room. Presently, the security room is occupied 24 hours per day.

During site investigations, it was found that security personnel were occupying the telephone room while the telephone equipment was installed in the original security room. However, the mechanical systems were not altered. AHU-3 is operated 24 hours per day to satisfy the air conditioning needs of the security room. Total annual cost to operate FC-5 and AHU-3 including weekends and normal unoccupied hours is $7,300. These costs were developed in the Electric model and are summarized below.

Off-Peak Usage	=	70,082 kWh
Intermediate Usage	=	24,775 kWh
On-Peak Usage	=	24,775 kWh
Summer kW	=	85 kW
Non-Summer kW	=	120 kW

Refer to the attached Existing Energy Usage Table for a more detailed breakdown of operating costs.

Proposed. Alter the existing systems in order to allow the telephone room to be supplied from AHU-3 and the security room from the fan coil. In addition, add an exhaust fan for ventilation. The exhaust fan will draw air from surrounding spaces to the security room for ventilation. This alteration will allow AHU-3 to be shutdown during unoccupied periods. The electric model was revised to show AHU-3 being shutdown during the unoccupied periods (0 hours of operation). Shutting down AHU-3 will lower the annual cost to operate these systems to $4,700 as shown on the following page. Electric usage and demand will be as follows:

Off-Peak kWh	=	9,763 kWh
Intermediate kWh	=	13,417 kWh
On-Peak kWh	=	24,967 kWh
Summer kW	=	86 kW
Non-Summer kW	=	121 kW

Refer to the attached Proposed Energy Usage Table for a more detailed breakdown of operating costs.

Construction Cost. The expected construction cost for this project is $7,000 (Reference attached cost estimate).

Material	$ 2,000
Labor	$ 4,000
Engineering	$ 1,000

Savings. The annual cost savings resulting from the implementation of this project will be $2,600 ($7,300 - $4,700).

Off-Peak kWh	=	60,319 kWh (70,082 kWh - 9,763 kWh)
Intermediate kWh	=	11,358 kWh (24,775 kWh - 13,417 kWh)
On-Peak kWh	=	-192 kWh (24,775 kWh - 24,967 kWh)
Summer kW	=	-1 kW (85 kW - 86 kW)
Non-Summer kW	=	-1 kW (120 kW - 121 kW)

Energy Usage	=	244 mmBtu ((60,319 kWh + 11,358 kWh - 192 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu)
Btu/sf	=	1,002 Btu/sf ((60,319 kWh + 11,358 kWh - 192 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion. The expected payback resulting from the implementation of this project is 2.7 years ($7,000 ÷ $2,600).

ECO-4
EXISTING ENERGY USAGE TABLE

			NON-SUMMER			SUMMER		
DESCRIPTION	NON-SUMMER KW	SUMMER KW	OFF-PEAK KWH	INTER. KWH	ON-PEAK KWH	OFF-PEAK KWH	INTER. KWH	ON-PEAK KWH
AHU-3 SF	79	56	26,775	9,450	9,450	19,125	6,750	6,750
AHU-3 RF	39	28	13,388	4,725	4,725	9,563	3,375	3,375
FC-5	2	1	718	277	277	513	198	198
TOTALS	120	85	40,881	14,452	14,452	29,201	10,323	10,323

Electric Cost =		$7,300	
Non- Summer:			
	KW	$792	120 kw/yr * $6.60/kw
	Off-peak KWH	$1,513	40,881 kwh/yr * $0.037/kwh
	Intermediate KWH	$665	14,452 kwh/yr * $0.046/kwh
	On- peak KWH	$766	14,452 kwh/yr * $0.053/kwh
Summer:			
	KW	$1,453	85 kw/yr * $17.09/kw
	Off-peak KWH	$993	29,201 kwh/yr * $0.034/kwh
	Intermediate KWH	$485	10,323 kwh/yr * $0.047/kwh
	On- peak KWH	$640	10,323 kwh/yr * $0.062/kwh
	Totals	$7,306	

ECO-4
PROPOSED ENERGY USAGE TABLE

			NON-SUMMER			SUMMER		
DESCRIPTION	NON-SUMMER KW	SUMMER KW	OFF-PEAK KWH	INTER. KWH	ON-PEAK KWH	OFF-PEAK KWH	INTER. KWH	ON-PEAK KWH
AHU-3 SF	79	56	3,150	5,250	9,450	2,250	3,750	6,750
AHU-3 RF	39	28	1,575	2,625	4,725	1,125	1,125	3,375
FC-5	2	1	718	277	277	513	198	198
EXHAUST FAN	1	1	252	112	112	180	80	80
TOTALS	121	86	5,695	8,264	14,564	4,068	5,153	10,403

Electric Cost =		$4,700	
Non- Summer:			
	KW	$797	121 kw/yr * $6.60/kw
	Off-peak KWH	$211	5,695 kwh/yr * $0.037/kwh
	Intermediate KWH	$380	8,264 kwh/yr * $0.046/kwh
	On- peak KWH	$772	14,564 kwh/yr * $0.053/kwh
Summer:			
	KW	$1,470	86 kw/yr * $17.09/kw
	Off-peak KWH	$138	4,068 kwh/yr * $0.034/kwh
	Intermediate KWH	$242	5,153 kwh/yr * $0.047/kwh
	On- peak KWH	$645	10,403 kwh/yr * $0.062/kwh
	Totals	$4,655	

ECO - 4
SECURITY ROOM AC RENOVATIONS

#	DESCRIPTION	QUAN.	UNITS	MATERIAL		LABOR		LINE TOTAL	#
				$/UNIT	TOTAL	$/UNIT	TOTAL		
1	MECHANICAL								1
2	EXHAUST FAN	1	LS	$200	$200	$200	$200	$400	2
3	DUCTWORK & ACCESSORIES	1	LS	$600	$600	$1,000	$1,000	$1,600	3
4	ELECTRICAL	1	LS	$600	$600	$600	$600	$1,200	4
5	CONTROLS	1	LS	$300	$300	$1,000	$1,000	$1,300	5
6	DEMOLITION	1	LS	$0	$0	$600	$600	$600	6
7					$0		$0	$0	7
8					$0		$0	$0	8
9					$0		$0	$0	9
10					$0		$0	$0	10
11					$0		$0	$0	11
12					$0		$0	$0	12
13					$0		$0	$0	13
14					$0		$0	$0	14
15					$0		$0	$0	15
16					$0		$0	$0	16
17					$0		$0	$0	17
18					$0		$0	$0	18
19					$0		$0	$0	19
20					$0		$0	$0	20
21					$0		$0	$0	21
22					$0		$0	$0	22
23					$0		$0	$0	23
24					$0		$0	$0	24
25					$0		$0	$0	25
26					$0		$0	$0	26
27					$0		$0	$0	27
28					$0		$0	$0	28
29					$0		$0	$0	29
30					$0		$0	$0	30
31					$0		$0	$0	31
32					$0		$0	$0	32
33					$0		$0	$0	33
34					$0		$0	$0	34
35					$0		$0	$0	35
36					$0		$0	$0	36
37					$0		$0	$0	37
38					$0		$0	$0	38
39					$0		$0	$0	39
40					$0		$0	$0	40
41					$0		$0	$0	41
42					$0		$0	$0	42
43					$0		$0	$0	43
44					$0		$0	$0	44
45					$0		$0	$0	45
46					$0		$0	$0	46
47					$0		$0	$0	47
48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53					$0		$0	$0	53
54					$0		$0	$0	54
55	CONTINGENCY 20%				$340		$580	$920	55
56					$0		$0	$0	56
57	**TOTALS>>>>>>>>>**				**$2,000**		**$4,000**	**$6,000**	57

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ENTECH ENGINEERING INC. 24-Aug-95

ECO-4A
Shutdown Chillers During Winter & Summer Unoccupied Periods

Existing. Implementation of ECO #4 is required before this ECO can be implemented. During the months of December through March, it is necessary to operate the central chilled water system to keep selected areas of the building cool. In the intermediate and summer months, these chillers also operate during unoccupied time periods to cool these same areas. Typically these areas are computer rooms and areas using fan coil units. The total cost to operate the central chilled water system during the entire year as calculated in the electric model is $75,400 (from the electric model).

Off-Peak kWh = 595,131 kWh

Intermediate kWh = 247,768 kWh

On-Peak kWh = 290,014 kWh

Summer kW = 1,226 kW

Non-Summer kW = 754 kW

Refer to attached Existing Energy Usage Table for a more detailed breakdown of operating costs.

Proposed. Shut down the central chilled water system during the winter months by installing a 30 ton air cooled chiller. The 30 ton unit will provide cooling for the computer rooms and fan coil units year round. Installation of this new unit will enable the central chilled water system to shut-down from December through March. In addition, during the months of April through November, the central chilled water system will be shut-down in the unoccupied time periods. Also the outdoor air dampers on the air handlers will need to be modulated closed to eliminate the outdoor air cooling load. The Energy Monitoring and Control System (EMCS) will be modified so as to shutdown the chillers and close the outdoor air dampers in the summer unoccupied periods. The expected annual cost to operate the central chilled water system and the new 30 ton chiller is $55,600.

Off-Peak kWh	=	177,608 kWh
Intermediate kWh	=	174,868 kWh
On-peak kWh	=	255,994 kWh
Summer kW	=	1,273 kW
Non-Summer kW	=	640 kW

Refer to attached Proposed Energy Usage Table for a more detailed breakdown of operating costs.

Construction Cost. The expected construction cost for this project is $77,000 (reference attached cost estimate).

Material	$37,000
Labor	$33,000
Engineering	$ 7,000

Savings. The annual cost savings resulting from implementation of this project will be $19,800 ($75,400 - $55,600).

Off-Peak kWh	=	417,523 kWh (595,131 kWh - 177,608 kWh)
Intermediate kWh	=	72,900 kWh (247,768 kWh - 174,868 kWh)
On-Peak kWh	=	34,070 kWh (290,014 kWh - 255,944 kWh)
Summer kW	=	-47 kW (1,226 kW - 1,273 kW)

Non-Summer kW	=	114 kW (754 kW - 640 kW)
Energy Usage	=	1,790 mmBtu ((417,523 kWh + 72,900 kWh + 34,070 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu
Btu/sf	=	7.353 Btu/sf ((417,523 kWh + 72,900 kWh + 34,070 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion. The expected payback resulting from the implementation of this project is 3.9 years ($77,000÷$19,800). There is no additional monetary savings due to reduced maintenance.

ECO-4A
EXISTING ENERGY USAGE TABLE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
CHILLER CH-2	476	955	149,057	52,224	76,563	272,294	123,193	135,406
CHW PUMP P-3	59	42	22,344	8,624	8,624	15,960	6,160	6,160
CW PUMP P-5	79	56	29,925	11,550	11,550	21,375	8,250	8,250
CLG TOWER	93	156	6,265	3,486	5,030	50,049	24,900	29,050
TOWER PAN HTRS	22	0	12,264	3,360	3,360	0	0	0
FAN COIL UNITS (5)	15	10	5,407	2,087	2,087	3,863	1,491	1,491
A/C UNITS (2)	10	7	3,691	1,425	1,425	2,637	1,018	1,018
TOTALS	754	1,226	228,953	82,756	108,639	366,178	165,012	181,375

Electric Cost = $75,400

Non- Summer:

KW	$4,975	754	kw/yr * $6.60/kw
Off-peak KWH	$8,471	228,953	kwh/yr * $0.037/kwh
Intermediate KWH	$3,807	82,756	kwh/yr * $0.046/kwh
On- peak KWH	$5,758	108,639	kwh/yr * $0.053/kwh

Summer:

KW	$20,952	1,226	kw/yr * $17.09/kw
Off-peak KWH	$12,450	366,178	kwh/yr * $0.034/kwh
Intermediate KWH	$7,756	165,012	kwh/yr * $0.047/kwh
On- peak KWH	$11,245	181,375	kwh/yr * $0.062/kwh

Totals $75,414

ECO-4A
PROPOSED ENERGY USAGE TABLE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
CHILLER CH-2	306	811	22,347	22,920	34,380	57,300	76,400	116,460
CHW PUMP P-3	16	49	1,210	1,210	1,814	3,024	3,360	6,160
CW PUMP P-5	21	66	1,620	1,620	2,430	4,050	4,500	8,250
CLG TOWER	57	183	3,735	2,490	2,490	12,450	16,600	29,050
TOWER PAN HTR	11	0	6,132	1,680	1,680	0	0	0
FAN COIL UNITS FAN MTR	15	11	1,176	1,960	1,960	840	1,400	1,400
A/C UNITS FAN MTR	10	7	3,990	1,862	1,862	2,850	1,330	1,330
NEW CHILLER	202	144	32,176	21,448	26,810	22,980	15,320	19,150
NEW PUMP	2	2	1,008	448	448	720	320	320
TOTALS	640	1,273	73,394	55,638	73,874	104,214	119,230	182,120

Electric Cost = $55,600

Non- Summer:			
KW	$4,223	640	kw/yr * $6.60/kw
Off-peak KWH	$2,716	73,394	kwh/yr * $0.037/kwh
Intermediate KWH	$2,559	55,638	kwh/yr * $0.046/kwh
On- peak KWH	$3,915	73,874	kwh/yr * $0.053/kwh
Summer:			
KW	$21,747	1,273	kw/yr * $17.09/kw
Off-peak KWH	$3,543	104,214	kwh/yr * $0.034/kwh
Intermediate KWH	$5,604	119,230	kwh/yr * $0.047/kwh
On- peak KWH	$11,291	182,120	kwh/yr * $0.062/kwh
Totals	$55,599		

AIR CONDITIONS:
Average Summer - 75 db/ 70 wb = Enthalpy of 34.1 btu/lb
Indoor Air - 75 db/ 50% RH = Enthalpy of 28.2 btu/lb
Supply Air - 55 db = Enthalpy of 23.6 btu/lb

CURRENT COOLING LOAD:
Outdoor Air = (49,000 cfm x (34.1-23.6) x 4.5)/12,000 = 193 Tons
Return Air = (114,000 cfm x (28.2-23.6) x 4.5)/12,000 = 197 Tons
Total = 390 Tons

PROPOSED COOLING LOAD:
Outdoor Air = (25,000 cfm x (34.1-23.6) x 4.5)/12,000 = 98 Tons
Return Air = (138,000 cfm x (28.2-23.6) x 4.5)/12,000 = 238 Tons
Total = 336 Tons

PERCENT REDUCTION:
336 Tons/390 Tons = 0.86 Therefor Reduce Electric Demand and Usage by 14%

ECO - 4A

PROVIDE SMALL CHILLER FOR WINTER COOLING REQUIREMENTS

#	DESCRIPTION	QUAN.	UNITS	MATERIAL $/UNIT	MATERIAL TOTAL	LABOR $/UNIT	LABOR TOTAL	LINE TOTAL	#
1	MECHANICAL								1
2	CHILLER	1	EA	$20,000	$20,000	$5,000	$5,000	$25,000	2
3	PIPING & ACCESSORIES	1	LS	$6,000	$6,000	$10,000	$10,000	$16,000	3
4	CONNECT TO EXIST. EQUIP.	1	LS	$700	$700	$2,000	$2,000	$2,700	4
5	ELECTRICAL	1	LS	$1,500	$1,500	$3,000	$3,000	$4,500	5
6	CONTROLS	1	LS	$2,000	$2,000	$5,000	$5,000	$7,000	6
7	RIG & SET	1	LS	$500	$500	$2,000	$2,000	$2,500	7
8	DEMOLITION	1	LS	$300	$300	$700	$700	$1,000	8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
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45									45
46									46
47									47
48									48
49									49
50									50
51									51
52									52
53	CONTINGENCY 20%				$6,200		$5,540	$11,740	53
54									54
55									55
	TOTALS>>>>>>>>>				**$37,000**		**$33,000**	**$70,000**	

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ENTECH ENGINEERING INC. 24-Aug-95

ECO-5
Electric Cooking Equipment To Natural Gas

Existing. Presently Marshall Hall utilizes some electric cooking equipment in its food preparation facilities. The equipment is used during the day to assist in producing an average of 300 meals, 5 days per week. Energy costs for each piece of equipment have been calculated in the electric model and are shown in detail on the following page. The equipment has an annual electric demand of 535 kW and a usage of 125,122 kWh. Annual electric cost is $11,400.

Off-Peak kWh = 45,648 kWh

Intermediate kWh = 59,064 kWh

On-Peak kWh = 20,410 kWh

Summer kW = 223 kW

Non-Summer kW = 312 kW

Proposed. Replace the existing electric cooking equipment with equivalent sized natural gas units. Additional natural gas lines will need to be installed in the kitchen and the existing gas service will require upgrading. The proposed retrofit will have an annual natural gas consumption of 638 mcf (based on 65% eff.). This quantity will yield an annual gas cost of $5,000.

#	Description	mcf	$
1	Griddle	127	$994
1	Fryers	121	$947
1	Char Broiler	106	$830
2	Coffee Urn	284	$2,224
	Totals	638	$5,000

Gas Usage	=	638 mcf (125,122 kWh x 3,413 Btu/kWh ÷ 65% eff ÷ 1,030,000 Btu/mcf) =
Gas Cost	=	$5,800 (638 mcf/yr x $7.83/mcf = $4,996 use $5,000)

Construction. Cost. The expected construction cost is for this project is $25,000. (Reference attached cost estimate).

Material	$ 15,000
Labor	$ 7,000
Engineering	$ 3,000

Savings. The expected savings for this ECO are about $6,400 ($11,400 - $5,000).

Off-Peak kWh	=	45,648 kWh (45,648 kWh - 0 kWh)
Intermediate kWh	=	59,064 kWh (59,064 kWh - 0 kWh)
On-Peak kWh	=	20,410 kWh (20,410 kWh - 0 kWh)
Summer kW	=	223 kW (223 kW - 0 kW)
Non-Summer kW	=	312 kW (312 kW - 0 kW)
Gas Usage	=	-638 mcf (0 mcf - 638 mcf)
Energy Usage	=	-230 mmBtu (((45,648 kWh + 59,064 kWh + 20,410 kWh) x 3,413 Btu/kWh) - 638 mcf x 1,030,000 Btu/mcf) ÷ 1,000,000 Btu/mmBtu
Btu/sf	=	-945 Btu/sf (((45,648 kWh + 59,064 kWh + 20,410 kWh) x 3,413 Btu/kWh) - 638 mcf x 1,030,000 Btu/mcf) ÷ 243,450 sf

Discussion. The payback for this ECO is 3.9 years ($25,000÷$6,400). Revenue from resale of existing kitchen equipment has not been included in the above calculations. There is no additional monetary savings due to reduced maintenance.

ECO - 5
ELECTRIC COOKING TO NATURAL GAS ECO
EXISTING ENERGY USAGE AND COST

			NON-SUMMER			SUMMER		
DESCRIPTION	NON-SUMMER KW	SUMMER KW	OFF-PEAK KWH	INTER. KWH	ON-PEAK KWH	OFF-PEAK KWH	INTER. KWH	ON-PEAK KWH
Griddle	59	42	5,040	6,720	3,000	3,600	4,800	1,800
Fryer	56	40	4,788	6,384	2,850	3,420	4,560	1,710
Char Broiler	49	35	4,200	5,600	2,500	3,000	4,000	1,500
Coffee Maker	74	53	6,300	7,500	1,050	4,500	6,000	750
Coffee Maker	74	53	6,300	7,500	3,750	4,500	6,000	1,500
TOTALS	312	223	26,628	33,704	13,150	19,020	25,360	7,260

Electric Cost = $11,392

Non- Summer:

KW	$2,059	312	kw/yr * $6.60/kw
Off-peak KWH	$985	26,628	kwh/yr * $0.037/kwh
Intermediate KWH	$1,550	33,704	kwh/yr * $0.046/kwh
On- peak KWH	$697	13,150	kwh/yr * $0.053/kwh

Summer:

KW	$3,811	223	kw/yr * $17.09/kw
Off-peak KWH	$647	19,020	kwh/yr * $0.034/kwh
Intermediate KWH	$1,192	25,360	kwh/yr * $0.047/kwh
On- peak KWH	$450	7,260	kwh/yr * $0.062/kwh

Totals $11,392

ECO - 5
ELECTRIC COOKING EQUIPMENT TO NATURAL GAS

	DESCRIPTION	QUAN.	UNITS	MATERIAL $/UNIT	MATERIAL TOTAL	LABOR $/UNIT	LABOR TOTAL	LINE TOTAL	#
1									1
2	GRIDDLE	1	EA	$2,600	$2,600	$500	$500	$3,100	2
3	FRYER	1	EA	$2,800	$2,800	$500	$500	$3,300	3
4	CHAR BROILER	1	EA	$2,600	$2,600	$500	$500	$3,100	4
5	COFFE MAKER	2	EA	$1,500	$3,000	$500	$1,000	$4,000	5
6	DEMOLITION	1	LOT		$0	$1,000	$1,000	$1,000	6
7	NATURAL GAS CONNECTIONS	1	LOT	$500	$500	$1,000	$1,000	$1,500	7
8	GAS PIPING 1" DIA.	100	LF	$5	$500	$7	$700	$1,200	8
9	ELECTRIC CONNECTIONS	1	LOT	$500	$500	$800	$800	$1,300	9
10					$0		$0	$0	10
11					$0		$0	$0	11
12					$0		$0	$0	12
13					$0		$0	$0	13
14					$0		$0	$0	14
15					$0		$0	$0	15
16					$0		$0	$0	16
17					$0		$0	$0	17
18					$0		$0	$0	18
19					$0		$0	$0	19
20					$0		$0	$0	20
21					$0		$0	$0	21
22					$0		$0	$0	22
23					$0		$0	$0	23
24					$0		$0	$0	24
25					$0		$0	$0	25
26					$0		$0	$0	26
27					$0		$0	$0	27
28					$0		$0	$0	28
29					$0		$0	$0	29
30					$0		$0	$0	30
31					$0		$0	$0	31
32					$0		$0	$0	32
33					$0		$0	$0	33
34					$0		$0	$0	34
35					$0		$0	$0	35
36					$0		$0	$0	36
37					$0		$0	$0	37
38					$0		$0	$0	38
39					$0		$0	$0	39
40					$0		$0	$0	40
41					$0		$0	$0	41
42					$0		$0	$0	42
43					$0		$0	$0	43
44					$0		$0	$0	44
45					$0		$0	$0	45
46					$0		$0	$0	46
47					$0		$0	$0	47
48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53					$0		$0	$0	53
54	CONTINGENCY				$2,500		$1,200	$3,700	54
55					$0		$0	$0	55
56									56
	TOTALS>>>>>>>>				**$15,000**		**$7,000**	**$22,000**	

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ENTECH ENGINEERING INC. 24-Aug-95

Proposed. Reduce building HVAC systems outdoor air quantities to a level of approximately 15% of the total building supply air. This reduction will yield a new outside air quantity of 28,000 CFM. This new quantity will still exceed code required ventilation rates. In addition, building exhaust air quantities will also be reduced by throttling back exhaust fan air flow utilizing dampers, resheaving fans or replacing fans. In some areas present exhaust systems can be eliminated altogether. Some areas such as the photographic room no longer have the need for exhaust fans. These areas should have the exhaust fans shut off.

Building operation diversity will account for a portion of outdoor air reduction. The present building system incorporates three (3) fans, each approximately 12,000 CFM, which operate in response to an increase in space pressurization. Space pressurization fluctuates with systems which operate from local switching or a space thermostats.

Reducing outside air quantities, a potential energy savings exists from cooling and heating load reductions. Total reduction in outdoor air approximately 28,000 CFM, will reduce chiller energy usage and demand by 11% as calculated on the following page. In addition, reducing outside air quantities during the space heating season will lower gas usage while overall energy cost for these areas will be \$35,400. Reference attached table for detailed calculations. No heating savings have been accounted for in this ECO. This is primarily due to the fact that the existing economizers will be utilized during the winter to provide the required 55°F leaving air temperature.

Off-Peak kWh = 242,342 kWh (272,294 kWh x 89%)

Intermediate kWh = 109,642 kWh (123,193 kWh x 89%)

On-Peak kWh = 120,511 kWh (135,406 kWh x 89%)

Summer kW = 850 kW (945 kW x 89%)

Electric Cost	=	\$35,400 (850 kW x \$17.09/kW + 242,342 kWh x \$0.034/kWh + 109,642 kWh x \$0.047/kWh + 120,511 kWh x \$0.062/kWh = \$35,391, use \$35,400)

Construction Cost. The expected construction cost for this project is \$16,000 (Reference attached cost estimate).

Material	\$ 4,000
Labor	\$ 11,000
Engineering	\$ 1,000

Savings. The annual cost savings resulting from the implementation of this project will be \$4,400 (\$39,800 - \$35,400).

Off-Peak kWh	=	29,952 kWh (272,294 kWh - 242,342 kWh)
Intermediate kWh	=	13,551 kWh (123,193 kWh - 109,642 kWh)
On-Peak kWh	=	14,895 kWh (135,406 kWh - 120,511 kWh)
Summer kW	=	105 kW (955 kW - 850 kW)
Energy Usage	=	199 mmBtu ((29,952 kWh + 13,551 kWh + 14,895 kWh) x 3,413 Btu/kWh)) ÷ 1,000,000 Btu/mmBtu
Btu/sf	=	818 Btu/sf ((29,952 kWh + 13,551 kWh + 14,895 kWh) x 3,413 Btu/kWh)) ÷ 243,450 sf

Discussion. The expected payback resulting from the implementation of this project is 3.6 years (\$16,000÷\$4,400).

ECO-6
EXISTING ENERGY USAGE TABLE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
CHILLER CH-2		955				272,294	123,193	135,406
TOTALS	0	955	0	0	0	272,294	123,193	135,406

Electric Cost = $39,800

Non- Summer:

KW	$0	0	kw/yr * $6.60/kw
Off-peak KWH	$0	0	kwh/yr * $0.037/kwh
Intermediate KWH	$0	0	kwh/yr * $0.046/kwh
On- peak KWH	$0	0	kwh/yr * $0.053/kwh

Summer:

KW	$16,321	955	kw/yr * $17.09/kw
Off-peak KWH	$9,258	272,294	kwh/yr * $0.034/kwh
Intermediate KWH	$5,790	123,193	kwh/yr * $0.047/kwh
On- peak KWH	$8,395	135,406	kwh/yr * $0.062/kwh

Totals $39,764

ECO-6
PROPOSED ENERGY USAGE TABLE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
CHILLER CH-2		850				242,342	109,642	120,511
TOTALS	0	850	0	0	0	242,342	109,642	120,511

Electric Cost = $35,400

Non- Summer:			
KW	$0	0	kw/yr * $6.60/kw
Off-peak KWH	$0	0	kwh/yr * $0.037/kwh
Intermediate KWH	$0	0	kwh/yr * $0.046/kwh
On- peak KWH	$0	0	kwh/yr * $0.053/kwh
Summer:			
KW	$14,527	850	kw/yr * $17.09/kw
Off-peak KWH	$8,240	242,342	kwh/yr * $0.034/kwh
Intermediate KWH	$5,153	109,642	kwh/yr * $0.047/kwh
On- peak KWH	$7,472	120,511	kwh/yr * $0.062/kwh
Totals	$35,391		

AIR CONDITIONS:

Average Summer - 75 db/ 70 wb = Enthalpy of 34.1 btu/lb
Indoor Air - 75 db/ 50% RH = Enthalpy of 28.2 btu/lb
Supply Air - 55 db = Enthalpy of 23.6 btu/lb

CURRENT COOLING LOAD:

Outdoor Air = (49,000 cfm x (34.1-23.6) x 4.5)/12,000 = 193 Tons
Return Air = (133,000 cfm x (28.2-23.6) x 4.5)/12,000 = 229 Tons
Total = 422 Tons

PROPOSED COOLING LOAD:

Outdoor Air = (28,000 cfm x (34.1-23.6) x 4.5)/12,000 = 110 Tons
Return Air = (154,000 cfm x (28.2-23.6) x 4.5)/12,000 = 266 Tons
Total = 376 Tons

PERCENT REDUCTION:

376 Tons/422 Tons = 0.89   Therefore Reduce Electric Demand and Usage by 11%

ECO - 6
REDUCE BUILDING HVAC OUTDOOR AIR REQUIREMENTS

#	DESCRIPTION	QUAN.	UNITS	MATERIAL $/UNIT	MATERIAL TOTAL	LABOR $/UNIT	LABOR TOTAL	LINE TOTAL	#
1	MECHANICAL								1
2	THROTTLE BACK FANS	8	EA	$50	$400	$200	$1,600	$2,000	2
3	RESHEAVE FANS	8	EA	$100	$800	$200	$1,600	$2,400	3
4	REPLACE FANS	4	EA	$500	$2,000	$200	$800	$2,800	4
5	TEST & BALANCE	20	EA		$0	$200	$4,000	$4,000	5
6	DEMOLITION	4	EA		$0	$200	$800	$800	6
7					$0		$0	$0	7
8					$0		$0	$0	8
9					$0		$0	$0	9
10					$0		$0	$0	10
11					$0		$0	$0	11
12					$0		$0	$0	12
13					$0		$0	$0	13
14					$0		$0	$0	14
15					$0		$0	$0	15
16					$0		$0	$0	16
17					$0		$0	$0	17
18					$0		$0	$0	18
19					$0		$0	$0	19
20					$0		$0	$0	20
21					$0		$0	$0	21
22					$0		$0	$0	22
23					$0		$0	$0	23
24					$0		$0	$0	24
25					$0		$0	$0	25
26					$0		$0	$0	26
27					$0		$0	$0	27
28					$0		$0	$0	28
29					$0		$0	$0	29
30					$0		$0	$0	30
31					$0		$0	$0	31
32					$0		$0	$0	32
33					$0		$0	$0	33
34					$0		$0	$0	34
35					$0		$0	$0	35
36					$0		$0	$0	36
37					$0		$0	$0	37
38					$0		$0	$0	38
39					$0		$0	$0	39
40					$0		$0	$0	40
41					$0		$0	$0	41
42					$0		$0	$0	42
43					$0		$0	$0	43
44					$0		$0	$0	44
45					$0		$0	$0	45
46					$0		$0	$0	46
47					$0		$0	$0	47
48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53					$0		$0	$0	53
54					$0		$0	$0	54
55	CONTINGENCY 20%				$640		$1,760	$2,400	55
56					$0		$0	$0	56
57	**TOTALS>>>>>>>>>**				**$4,000**		**$11,000**	**$15,000**	57

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ENTECH ENGINEERING INC. 24-Aug-95

ECO-7
Replace Electric Dishwasher Booster Heater

Existing. A 45 kW, electric booster heater increases water temperature to the dishwasher from 140° to 180°F. From the Electric Model, the annual demand and usage for the water heater is estimated to be 379 kW and 51,300 kWh. The annual operating cost is $6,700.

Off-Peak kWh	=	8,100 kWh
Intermediate kWh	=	21,600 kWh
On-Peak kWh	=	21,600 kWh
Summer kW	=	221 kW
Non-Summer kW	=	158 kW

Proposed. Disconnect and remove the existing electric booster heater and install a new a gas-fired domestic hot water generator. The new water heater will be located in the same mechanical room as the existing gas-fired domestic hot water heater. In addition, new gas lines and hot water piping to the kitchen will need to be installed. The new water heater will have an annual gas usage of 212 mcf and an annual cost energy cost of approximately $1,700.

Gas Usage	=	212 mcf/yr ((51,300 kWh x 3,413 Btu/kWh) ÷ (80% x 1,030,000 Btu/mcf))
Gas Cost	=	$1,700 (212 mcf/yr x $7.83/mcf = $1,659, use $1,700)

Construction Cost. The expected construction cost for this project is $20,000. (reference attached cost estimate).

Material	$ 9,000
Labor	$ 9,000
Engineering	$ 2,000

Savings. The annual cost savings resulting from the implementation of this project will be \$5,000 (\$6,700 - \$1,700).

Off-Peak kWh	=	8,100 kWh ((4,725 kWh + 3,375 kWh) - 0 kWh)
Intermediate kWh	=	21,600 kWh ((12,600 kWh + 9,000 kWh) - 0 kWh)
On-Peak kWh	=	21,600 kWh ((12,600 kWh + 9,000 kWh) - 0 kWh)
Summer kW	=	158 kW (158 kW - 0 kW)
Non-Summer kW	=	221 kW (221 kW - 0 kW)
Gas Usage	=	-212 mcf (0 mcf - 212 mcf)
Energy Usage	=	-44 mmBtu [(((8,100 kWh +21,600 kWh + 21,600 kWh) x 3,413 Btu/kWh) - (212 mcf x 1,030,000 Btu/mcf)) ÷ 1,000,000 Btu/mmBtu]
Btu/sf	=	-178 Btu/sf [(((8,100 kWh +21,600 kWh + 21,600 kWh) x 3,413 Btu/kWh) - (212 mcf x 1,030,000 Btu/mcf)) ÷ 243,450 sf]

Discussion. The expected payback resulting from the implementation of this project is 4.0 years (\$20,000÷\$5,000). There is no additional monetary savings due to reduced maintenance.

ECO - 7
KITCHEN HOT WATER HEATER TO GAS

#	DESCRIPTION	QUAN.	UNITS	MATERIAL $/UNIT	MATERIAL TOTAL	LABOR $/UNIT	LABOR TOTAL	LINE TOTAL	#
1									1
2	DEMOLITION OF ELEC HEATER	1	EA	$0	$0	$500	$500	$500	2
3	GAS HW HEATER 100 GAL STORAGE	1	EA	$4,000	$4,000	$2,000	$2,000	$6,000	3
4	GAS PIPE 1"	50	LF	$3	$150	$9	$450	$600	4
5	GAS FLUE 6"	15	LF	$40	$600	$30	$450	$1,050	5
6	ROOF OPENING	1	EA	$200	$200	$300	$300	$500	6
7	CONCRETE PAD	1	EA	$100	$100	$100	$100	$200	7
8	HOT WATER PIPE 1"	200	LF	$4	$800	$9	$1,800	$2,600	8
9	ELECTRICAL REQUIREMENTS	1	LOT	$1,500	$1,500	$1,500	$1,500	$3,000	9
10					$0		$0	$0	10
11					$0		$0	$0	11
12					$0		$0	$0	12
13					$0		$0	$0	13
14					$0		$0	$0	14
15					$0		$0	$0	15
16					$0		$0	$0	16
17					$0		$0	$0	17
18					$0		$0	$0	18
19					$0		$0	$0	19
20					$0		$0	$0	20
21					$0		$0	$0	21
22					$0		$0	$0	22
23					$0		$0	$0	23
24					$0		$0	$0	24
25					$0		$0	$0	25
26					$0		$0	$0	26
27					$0		$0	$0	27
28					$0		$0	$0	28
29					$0		$0	$0	29
30					$0		$0	$0	30
31					$0		$0	$0	31
32					$0		$0	$0	32
33					$0		$0	$0	33
34					$0		$0	$0	34
35					$0		$0	$0	35
36					$0		$0	$0	36
37					$0		$0	$0	37
38					$0		$0	$0	38
39					$0		$0	$0	39
40					$0		$0	$0	40
41					$0		$0	$0	41
42					$0		$0	$0	42
43					$0		$0	$0	43
44					$0		$0	$0	44
45					$0		$0	$0	45
46					$0		$0	$0	46
47					$0		$0	$0	47
48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53					$0		$0	$0	53
54					$0		$0	$0	54
55	CONTINGENCY				$1,650		$1,900	$3,550	55
56					$0		$0	$0	56
57	**TOTALS>>>>>>>>**				**$9,000**		**$9,000**	**$18,000**	57

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ENTECH ENGINEERING INC. 24-Aug-95

ECO-8
100 HPS Loading Dock Luminaires

Existing. Presently, Marshall Hall utilizes approximately (28) 175 watt recessed mercury vapor luminaires in the first floor loading dock. The current lamps have an initial lumen rating of 14,000 and a maintained level of 10,000. From the attached sheet, the annual electric demand for this area is 65 kW and usage is 49,228 kWh. These quantities produce an annual cost of $2,800. All quantities have been developed from the Light Model and are calculated in the attachment. The table below summarizes the estimates.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	38	15,042	6,837	6,837	$1,480
Summer	27	10,744	4,884	4,884	$1,360
Totals	65	25,786	11,721	11,721	$2,800

Proposed. Remove the existing luminaires and install new recessed 100 watt HPS luminaires. The new 100 watt HPS lamps will provide an initial lumen output of 9,500 and maintained level of 8,500 lumens (15% decrease). Replacement luminaires will be capable of being housed in the same location with minor alterations. The retrofit is expected to lower annual electric demand to 36 kW and electric usage to 28,130 kWh based upon the reduced wattage of lamp used. Annual energy cost will be lowered to $1,600.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	21	8,595	3,907	3,907	$840
Summer	15	6,139	2,791	2,791	$770
Totals	36	14,734	6,698	6,698	$1,600

Construction Cost.	The expected construction cost this project will be \$6,500. (reference attached cost estimate).

Material	\$ 4,200
Labor	\$ 1,700
Engineering	\$ 600

Savings. The annual cost savings resulting from the implementation of this project will be \$1,200 (\$2,800 - \$1,600).

Off-Peak kWh = 11,052 kWh/yr (25,786 kWh/yr - 14,734 kWh/yr)

Intermediate kWh = 5,023 kWh/yr (11,721 kWh/yr - 6,698 kWh/yr)

On-Peak kWh = 5,023 kWh/yr (11,721 kWh/yr - 6,698 kWh/yr)

Non-Summer kW = 18 kW/yr (38 kW/yr - 21 kW/yr)

Summer kW = 13 kW/yr (27 kW/yr - 15 kW/yr)

Energy Usage = 72 mmBtu/yr ((11,052 kWh + 5,023 kWh + 5,023 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu

Btu/sf = 296 Btu/sf ((11,052 kWh + 5,023 kWh + 5,023 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion. The expected payback resulting from the implementation of this project is 5.4 years (\$6,500 ÷ \$1,200). Illumination levels are expected to decrease by approximately 15% from current levels. However, it felt that the decrease will not impede any activities which will occur in the space. Ft. McNair personnel also concur with this assessment. There will be no additional monetary savings due to reduced maintenance.

ECO-8
100 Watt HPS Dock Lights

				EXISTING								
				Non-Summer Annual Totals				Summer Annual Totals				
Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
176A, Loading Area	28	1	175	15,042	6,837	6,837	38	10,744	4,884	4,884	27	$2,837
Sub-totals	28			15,042	6,837	6,837	38	10,744	4,884	4,884	27	$2,800

				PROPOSED								
				Non-Summer Annual Totals				Annual Totals				
Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
176A, Loading Area	28	1	100	8,595	3,907	3,907	21	6,139	2,791	2,791	15	$1,621
Sub-totals	28			8,595	3,907	3,907	21	6,773	3,079	3,079	15	$1,600

				Construction Cost					
Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Material $	Labor $	Engineering $	Total $	Savings $	Payback Yrs
176A, Loading Area	28	1	100	$4,200	$1,700	$600	$6,500	$1,200	5.3
Sub-totals	28			$4,200	$1,700	$600	$6,500	$1,200	5.4

Number of Lamps	28
Number of Ballasts	28

Non-Summer Incrementals		Summer Incrementals	
Winter Incremental Demand Cost $/Kw =	$6.60	Winter Incremental Demand Cost $/Kw =	$17.09
Off-Peak Incremental Usage Cost $/Kwh =	$0.0370	Off-Peak Incremental Usage Cost $/Kwh =	$0.0340
Intermediate Incremental Usage Cost $/Kwh	$0.0460	Intermediate Incremental Usage Cost $/Kw	$0.0470
On-Peak Incremental Usage Cost $/Kwh =	$0.0530	On-Peak Incremental Usage Cost $/Kwh =	$0.0620

NOTE #1: FOR BALLASTED LUMINAIRE A BALLAST FACTOR OF 1.15 IS USED, INCANDESCENT LUMINAIRE USE 1.

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ECO-9
4' T-8 Lamp Retrofit

Existing. Presently, Marshall Hall utilizes approximately 3,083 fluorescent luminaires containing 7,458 lamps and 4,112 ballasts in areas which are substantially occupied. The luminaires range from single to quad lamped and basically utilize 40 watt, cool white lamps with standard energy efficient magnetic ballasts. From the attached sheets, the annual electric demand for these areas is 3,904 kW and usage is 1,000,983 kWh. Annual costs for the existing lights are $93,800. All quantities have been developed from the Light Model and are calculated in the attachment. The table below summarizes the estimates.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	2,277	59,999	210,278	313,630	$43,540
Summer	1,627	42,871	150,186	224,019	$50,210
Totals	3,904	102,870	360,464	537,649	$93,800

Proposed. Remove the existing lamps and ballasts and install new Sylvania Octron (or equivalent) T-8 lighting system with electronic ballasts. The average electrical use per lamp will vary from 28 watts for a four lamp luminaire to approximately 30 watts per lamp for single and two lamp luminaires. For the purposes of this ECO, an average lamp wattage of 29 will be used. In addition, four and three lamp luminaires will receive one electronic ballast in place of two existing. Octron lamps are thinner and can be installed into the luminaire using existing pin connectors. based on the 29 watts per lamp the retrofit is expected to lower electric demand to 2,462 kW/yr and electric usage to 631,053 kWh/yr. The annual energy cost for the retrofit is $59,100.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	1,436	37,825	132,567	197,723	$27,450
Summer	1,026	27,027	94,682	141,229	$31,660
Totals	2,462	64,852	227,249	338,952	$59,100

Construction Cost. The expected construction cost for this project will be $210,000. (reference attached data sheets).

Material	$125,900
Labor	$ 61,700
Engineering	$ 22,400

Savings. The annual cost savings resulting from the implementation of this project will be $34,700 ($93,800 - $59,100).

Non-Summer kW = 841 kW/yr (2,277 kW/yr - 1,436 kW/yr)

Summer kW = 601 kW/yr (1,627 kW/yr - 1,026 kW/yr)

Off-Peak kWh = 38,018 kWh/yr (102,870 kWh/yr - 64,852 kWh/yr)

Intermediate kWh = 133,215 kWh/yr (360,464 kWh/yr - 227,249 kWh/yr)

On-Peak kWh = 198,697 kWh/yr (537,649 kWh/yr - 338,952 kWh/yr)

Energy Usage = 1,263 mmBtu/yr ((38,018 kWh + 133,215 kWh + 198,697 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu

Btu/sf = 5,186 Btu/sf ((38,018 kWh + 133,215 kWh + 198,697 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion. The expected payback resulting from the implementation of this project is 6.1 years ($210,000 ÷ $34,700). The retrofit is estimated to provide a reduction in cooling costs and no increase in heating costs, This analysis is shown on the following page.

Cooling Savings, 5 Summer Months

Description	Light Savings	Equiv Cool @ 5 cop	Cost Savings
Off-Peak, kWh	15,844	3,169	$108
Intermediate, kWh	55,504	11,101	$522
On-Peak, kWh	82,790	16,558	$1,027
Demand, kW	601	120	$2,054
Totals			$3,700

The retrofit will reduce HVAC cost by $3,700. Thus the simple payback for this project will be lowered to 5.5 years ($210,000 ÷ ($34,700 + $3,700)). There is no additional monetary savings due to reduced maintenance. The use of electronic ballasts has been known to cause harmonic distortion problems. However, the occurrence is quite small and can be very dependent upon ballast and electrical distribution quality.

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Existing Non-Summer Annual Totals				Existing Summer Annual Totals									Proposed Annual Totals								
				Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Material $	Labor $	Total $	Payback Yrs
AHU-1N & AHU-1S																									
Ground Floor:																									
Lobby & Vestibules	20	1	40	140	558	837	6.1	100	399	598	4.4	$250	88	352	528	3.8	63	252	377	2.8	$158	$850	$400	$1,250	13.5
Second Floor:																									
205, Corridor	3	2	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$135	$60	$195	7.1
AHU-2																									
Ground Floor:																									
170, Workroom	21	3	40		1,758	2,637	19		1,256	1,884	13.8	$760		1,108	1,662	12.2		792	1,188	8.7	$479	$998	$420	$1,418	5.0
170A, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
171, Bookstore	13	2	40	181	726	1,088	8	130	518	777	5.7	$325	114	458	686	5.0	82	327	490	3.6	$205	$585	$260	$845	7.0
173, Mail Room	11	3	40	230	921	1,381	10	164	658	987	7.2	$411	145	581	871	6.4	103	415	622	4.5	$259	$523	$220	$743	4.9
173A, Office	1	3	40	21	84	126	1	15	60	90	0.7	$38	13	53	79	0.6	9	38	57	0.4	$24	$48	$20	$68	4.8
174, Pick Up	6	3	40	126	502	753	6	90	359	538	3.9	$224	79	316	475	3.5	57	226	339	2.5	$141	$285	$120	$405	4.9
174A, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
174B, Office Area	9	3	40	188	753	1,130	8	135	538	807	5.9	$337	119	475	712	5.2	85	339	509	3.7	$212	$428	$180	$608	4.9
174C, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$190	$80	$270	4.9
174D, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
175, Store Room	35	2	40		1,953	2,930	21		1,395	2,093	15.3	$843		1,231	1,847	13.5		879	1,320	9.6	$532	$1,575	$700	$2,275	7.3
176, Breakout	4	2	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$180	$80	$260	7.1
176A, Loading Area	1	2	40	246	112	112	1	175	80	80	0.4	$46	155	71	71	0.4	110	50	50	0.3	$29	$45	$20	$65	3.9
Corridor	15	2	40	209	837	1,256	9	150	598	897	6.6	$375	132	528	792	5.8	95	377	566	4.2	$236	$675	$300	$975	7.0
177, Reception	5	2	40	70	279	419	3	50	199	299	2.2	$125	44	176	264	2.0	32	125	189	1.4	$79	$225	$100	$325	7.0
177A, Office	2	2	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$90	$40	$130	7.0
177B, Office	2	2	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$90	$40	$130	7.0
177C, Office	4	2	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$180	$80	$260	7.1
177D, Office	2	2	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$90	$40	$130	7.0
178, Classroom	20	2	40	279	1,116	1,674	12	199	797	1,196	8.7	$498	176	704	1,055	7.7	125	502	754	5.5	$314	$900	$400	$1,300	7.1
180, Holding	2	2	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$90	$40	$130	7.0
181, Print Work Room	21	4	40	586	2,344	3,516	26	419	1,674	2,512	18.4	$1,049	369	1,478	2,217	16.2	264	1,055	1,584	11.6	$661	$1,050	$420	$1,470	3.8
181, Print Work Room	2	2	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$90	$40	$130	7.0
181D, Portrait Studio	3	2	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$135	$60	$195	7.1
181F, Janitor's Closet	1	3	40	21	84	126	1	15	60	90	0.7	$38	13	53	79	0.6	9	38	57	0.4	$24	$48	$20	$68	4.8
181G, Porox. Camera	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
181H, Color Room	3	4	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$150	$60	$210	3.8
181I, Pick Up Room	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
181J, Camera Room	1	4	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$50	$20	$70	3.8
181K, Slide Mounting	1	4	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$50	$20	$70	3.8
181L, Film Viewing	1	4	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$50	$20	$70	3.8
183, Corridor	14	2	40	195	781	1,172	9	140	558	837	6.1	$349	123	492	739	5.4	88	352	528	3.8	$220	$630	$280	$910	7.1
183A, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
183B, A.V. Control	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$300	$120	$420	3.8
183C, Studio	9	2	40	126	502	753	6	90	359	538	3.9	$224	79	316	475	3.5	57	226	339	2.5	$141	$405	$180	$585	7.1
183E, Typesetting	8	3	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$380	$160	$540	4.9
183E-2, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$50	$20	$70	3.8
183F, Graphic Arts	20	3	40	419	1,674	2,512	18	299	1,196	1,794	13.1	$749	264	1,055	1,584	11.6	189	754	1,131	8.3	$472	$950	$400	$1,350	4.9
183F-2, Work Room	12	4	40	335	1,340	2,009	15	239	957	1,435	10.5	$599	211	845	1,267	9.3	151	603	905	6.6	$378	$600	$240	$840	3.8
183G, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
183H, Conference	4	4	40		447	670	5		319	478	3.5	$193		282	422	3.1		201	301	2.2	$122	$200	$80	$280	3.9
183I, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
183J, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
183K, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
183L, Printing	27	4	40	753	3,014	4,521	33	538	2,153	3,229	23.6	$1,347	475	1,900	2,850	20.8	339	1,357	2,036	14.9	$849	$1,350	$540	$1,890	3.8
183M, Pick Up Room	4	3	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$190	$80	$270	4.9
183N, Files	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
183O, Office Area	7	3	40	147	586	879	6	105	419	628	4.6	$262	93	369	554	4.0	66	264	396	2.9	$165	$333	$140	$473	4.9
183P, Corridor	2	2	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$90	$40	$130	7.0
Men's Room	9	2	40	126	502	753	6	90	359	538	3.9	$224	79	316	475	3.5	57	226	339	2.5	$141	$405	$180	$585	7.1
Women's Room	12	2	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$540	$240	$780	7.1
198, Stress Testing	15	2	40	209	837	1,256	9	150	598	897	6.6	$375	132	528	792	5.8	95	377	566	4.2	$236	$675	$300	$975	7.0
198A, Locker Room	10	2	40	140	558	837	6	100	399	598	4.4	$250	88	352	528	3.8	63	252	377	2.8	$158	$450	$200	$650	7.0
198B, Security Desk	3	3	40	1,105	502	502	3	789	359	359	2.0	$209	697	316	316	1.8	497	226	226	1.3	$132	$143	$60	$203	2.6
199, Exercise Room	9	2	40	126	502	753	6	90	359	538	3.9	$224	79	316	475	3.5	57	226	339	2.5	$141	$405	$180	$585	7.1
Corridor #1	11	2	40	153	614	921	7	110	439	658	4.8	$274	96	387	581	4.2	69	277	415	3.0	$173	$495	$220	$715	7.1
Corridor #2	15	2	40	209	837	1,256	9	150	598	897	6.6	$375	132	528	792	5.8	95	377	566	4.2	$236	$675	$300	$975	7.0
Clooridor #3	14	2	40	195	781	1,172	9	140	558	837	6.1	$349	123	492	739	5.4	88	352	528	3.8	$220	$630	$280	$910	7.1
Corridor #4	13	2	40	181	726	1,451	8	130	518	1,037	5.7	$360	114	458	915	5.0	82	327	654	3.6	$227	$585	$260	$845	6.3
AHU-3																									
Ground Floor:																									
184, Classroom	20	2	40		1,116	1,674	12		797	1,196	8.7	$481		704	1,055	7.7		502	754	5.5	$303	$900	$400	$1,300	7.3
185, A.V. Room	10	3	40		837	1,256	9		598	897	6.6	$362		528	792	5.8		377	566	4.2	$228	$475	$200	$675	5.0
185, A.V. Room	3	2	40		167	251	2		120	179	1.3	$72		105	158	1.1		76	113	0.8	$45	$135	$60	$195	7.3
186, Classroom	22	2	40		1,228	1,842	14		877	1,316	9.6	$530		774	1,161	8.5		553	830	6.1	$334	$990	$440	$1,430	7.3
187, Classroom	22	2	40		1,228	1,842	14		877	1,316	9.6	$530		774	1,161	8.5		553	830	6.1	$334	$990	$440	$1,430	7.3
188, Office Area	22	3	40	460	1,842	2,763	20	329	1,316	1,973	14.4	$823	290	1,161	1,742	12.7	207	830	1,244	9.1	$519	$1,045	$440	$1,485	4.9
188, Office Area	3	2	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$135	$60	$195	7.1
188A, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
191, Telephones	3	2	40		167	251	2		120	179	1.3	$72		105	158	1.1		76	113	0.8	$45	$135	$60	$195	7.3
194, Holding	2	3	40		167	251	2		120	179	1.3	$72		105	158	1.1		76	113	0.8	$45	$95	$40	$135	5.1
196, Classroom	22	2	40		1,228	1,842	14		877	1,316	9.6	$530		774	1,161	8.5		553	830	6.1	$334	$990	$440	$1,430	7.3
197, Classroom	16	2	40		893	1,340	10		638	957	7.0	$386		563	845	6.2		402	603	4.4	$243	$720	$320	$1,040	7.3
Second Floor:																									
242, Reading Room	8	4	40		893	1,340	10		638	957	7.0	$386		563	845	6.2		402	603	4.4	$243	$400	$160	$560	3.9
242A, Mechanical Room	12	2	40		670	1,005	7		478	718	5.2	$288		422	634	4.6		301	453	3.3	$182	$540	$240	$780	7.3
242B, Corridor	8	2	40		447	670	5		319	478	3.5	$193		282	422	3.1		201	301	2.2	$122	$360	$160	$520	7.3
243, Group Viewing	12	3	40		1,005	1,507	11		718	1,076	7.9	$434		634	950	6.9		453	678	5.0	$274	$570	$240	$810	5.0
244, Reserve Books	60	2	40		3,349	5,023	37		2,392	3,588	26.2	$1,445		2,111	3,167	23.1		1,508	2,262	16.5	$911	$2,700	$1,200	$3,900	7.3
245, Office Area	27	4	40	753	3,014	4,521	33	538	2,153	3,229	23.6	$1,347	475	1,900	2,850	20.8	339	1,357	2,036	14.9	$849	$1,350	$540	$1,890	3.8
245, Office Area	2	2	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$90	$40	$130	7.0
245A, Work Room	5	3	40	105	419	628	5	75	299	449	3.3	$188	66	264	396	2.9	47	189	283	2.1	$118	$238	$100	$338	4.9
245B, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$50	$20	$70	3.8
245C, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
245D, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
246, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
249, Holding	2	2	40		112	167	1		80	120	0.9	$49		71	105	0.8		50	76	0.6	$31	$90	$40	$130	7.3
Third Floor:																									
333, Office Area	18	3	40	377	1,507	2,260	17	269	1,076	1,615	11.8	$673	238	950	1,425	10.4	170	678	1,018	7.4	$425	$855	$360	$1,215	4.9
333A, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$150	$60	$210	3.8
333B, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
333G, Corridor	3	2	40		167	251	2		120	179	1.3	$72		105	158	1.1		76	113	0.8	$45	$135	$60	$195	7.3
334, Holding	2	2	40		112	167	1		80	120	0.9	$49		71	105	0.8		50	76	0.6	$31	$90	$40	$130	7.3

4' T-8 R[illegible]

Room or Area Description	No. Of Lum.	[illegible] Lum	Watts Per Lamp	Existing Non-Summer Annual Totals				Existing Summer Annual Totals					Proposed Annual Totals												
				Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Material $	Labor $	Total $	Payback Yrs
335, Library	67	2	40	935	3,739	5,609	41	668	2,671	4,007	29.3	$1,672	589	2,357	3,336	25.8	421	1,684	2,526	18.5	$1,054	$3,015	$1,340	$4,355	7.0
335A, Study Room	2	2	40		112	167	1		80	120	0.9	$49		71	105	0.8		50	76	0.6	$31	$90	$40	$130	7.3
AHU-5																									
Ground Floor:																									
115, Men's Room	9	2	40	126	502	753	6	90	359	538	3.9	$224	79	316	475	3.5	57	226	339	2.5	$141	$405	$180	$585	7.1
116, Women's Room	10	2	40	140	558	837	6	100	399	598	4.4	$250	88	352	528	3.8	63	252	377	2.8	$158	$450	$200	$650	7.0
119, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$150	$60	$210	3.8
120, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$150	$60	$210	3.8
121, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$150	$60	$210	3.8
122, Open Office Area	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$300	$120	$420	3.8
123, Corridor	21	2	40	293	1,172	1,758	13	209	837	1,256	9.2	$524	185	739	1,108	8.1	132	528	792	5.8	$330	$945	$420	$1,365	7.0
124, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$150	$60	$210	3.8
125, Passageway	2	2	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$90	$40	$130	7.0
125, Passageway	1	3	40	21	84	126	1	15	60	90	0.7	$38	13	53	79	0.6	9	38	57	0.4	$24	$48	$20	$68	4.8
126, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
127, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
128, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
129, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
130, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
131, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
132, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
133, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
134, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
135, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
136, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
137, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
138, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
139, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
140, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
141, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
142, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
143, Mail Room	3	4	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$150	$60	$210	3.8
144, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$190	$80	$270	4.9
144A, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
144B, Office	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$300	$120	$420	3.8
144C, Office	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$300	$120	$420	3.8
145, Office	8	3	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$380	$160	$540	4.9
146, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
147, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
148, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
149, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
150, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
151, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$150	$60	$210	3.8
152, Library/Class	10	4	40	279	1,116	1,674	12	199	797	1,196	8.7	$498	176	704	1,055	7.7	125	502	754	5.5	$314	$500	$200	$700	3.8
152B, Open Office Area/Corri	12	4	40	335	1,340	2,009	15	239	957	1,435	10.5	$599	211	845	1,267	9.3	151	603	905	6.6	$378	$600	$240	$840	3.8
152B, Open Office Area/Corri	2	2	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$90	$40	$130	7.0
153, Mechanical Room	6	2	40		335	502	4		239	359	2.6	$144		211	316	2.3		151	226	1.6	$91	$270	$120	$390	7.3
153A, Passageway	2	2	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$90	$40	$130	7.0
Second Floor:																									
206, Men's Room	6	2	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$270	$120	$390	7.1
207, Men's Room	7	2	40	98	391	586	4	70	279	419	3.1	$176	62	247	369	2.7	44	176	264	2.0	$111	$315	$140	$455	7.0
209, Office Area	12	3	40	251	1,005	1,507	11	179	718	1,076	7.9	$450	158	634	950	6.9	113	453	678	5.0	$283	$570	$240	$810	4.9
(Corridor)	9	2	40	126	502	753	6	90	359	538	3.9	$224	79	316	475	3.5	57	226	339	2.5	$141	$405	$180	$585	7.1
209A, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209B, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209C, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209D, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209E, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209F, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209H, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209I, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209J, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209K, Closet	1	2	40	14	56	84	1	10	40	60	0.4	$24	9	35	53	0.4	6	25	38	0.3	$15	$45	$20	$65	7.2
209L, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209M, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209N, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
209O, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209P, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
209Q, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
210, Office	8	3	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$380	$160	$540	4.9
210A, Pick Up	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
210B, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
210C, Office	8	3	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$380	$160	$540	4.9
210D, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
210E, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
210F, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
210G, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$50	$20	$70	3.8
210H, Office	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$300	$120	$420	3.8
210H, Office	1	2	40	14	56	84	1	10	40	60	0.4	$24	9	35	53	0.4	6	25	38	0.3	$15	$45	$20	$65	7.2
211, Security	17	3	40	6,262	1,423	2,135	16	4,473	1,017	1,525	11.1	$997	3,948	897	1,346	9.8	2,820	641	961	7.0	$629	$808	$340	$1,148	3.1
211A, Office	6	3	40	126	502	753	6	90	359	538	3.9	$224	79	316	475	3.5	57	226	339	2.5	$141	$285	$120	$405	4.9
211B, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
211C, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
211D, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
212, Office Area	10	4	40	279	1,116	1,674	12	199	797	1,196	8.7	$498	176	704	1,055	7.7	125	502	754	5.5	$314	$500	$200	$700	3.8
212, Office Area	4	2	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$180	$80	$260	7.1
212A, Biofeedback	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$300	$120	$420	3.8
212B, Storage	2	2	40		112	167	1		80	120	0.9	$49		71	105	0.8		50	76	0.6	$31	$90	$40	$130	7.3
212C, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$150	$60	$210	3.8
212D, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
212E, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
212F, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
212G, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
212H, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
212I, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
213, Mechanical Room	6	2	40		335	502	4		239	359	2.6	$144		211	316	2.3		151	226	1.6	$91	$270	$120	$390	7.3
Lobby, Corridors, & Open Are	30	2	40	419	1,674	2,512	18	299	1,196	1,794	13.1	$749	264	1,055	1,584	11.6	189	754	1,131	8.3	$472	$1,350	$600	$1,950	7.0
Lobby, Corridors, & Open Are	5	1	40	35	140	209	2	25	100	150	1.1	$62	22	88	132	0.9	16	63	95	0.7	$39	$213	$100	$313	13.6
Third Floor:																									
309, Office Area	10	3	40	209	837	1,256	9	150	598	897	6.6	$375	132	528	792	5.8	95	377	566	4.2	$236	$475	$200	$675	4.9

4' T-8 Retrofit

Room or Area Description	No. of Lum.	Lamps Per Lum	Watts Per Lamp	Existing Non-Summer Annual Totals Off-Peak Kwh	Existing Non-Summer Annual Totals Inter. Kwh	Existing Non-Summer Annual Totals On-Peak Kwh	Existing Non-Summer Annual Totals Winter kW	Existing Summer Annual Totals Off-Peak Kwh	Existing Summer Annual Totals Inter. Kwh	Existing Summer Annual Totals On-Peak Kwh	Existing Summer Annual Totals Summer kW	Cost $	Proposed Annual Totals Off-Peak Kwh	Proposed Annual Totals Inter. Kwh	Proposed Annual Totals On-Peak Kwh	Proposed Annual Totals Winter kW	Proposed Annual Totals Off-Peak Kwh	Proposed Annual Totals Inter. Kwh	Proposed Annual Totals On-Peak Kwh	Proposed Annual Totals Summer kW	Proposed Annual Totals Cost $	Material $	Labor $	Total $	Payback Yrs
309A, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
309B, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
309B-1,	1	2	40	14	56	84	1	10	40	60	0.4	$24	9	35	53	0.4	6	25	38	0.3	$15	$45	$20	$65	7.2
309C, Office	5	4	40	140	558	837	6	100	399	598	4.4	$250	88	352	528	3.8	63	252	377	2.8	$158	$250	$100	$350	3.8
309D, Storage	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
309E, Passageway	3	2	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$135	$60	$195	7.1
310, Men's Room	4	2	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$180	$80	$260	7.1
311, Women's Room	4	2	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$180	$80	$260	7.1
314, Office Area	26	4	40	726	2,902	4,353	32	518	2,073	3,110	22.7	$1,297	458	1,830	2,744	20.0	327	1,307	1,961	14.3	$818	$1,300	$520	$1,820	3.8
314, Office Area	9	2	40	126	502	753	6	90	359	538	3.9	$224	79	316	475	3.5	57	226	339	2.5	$141	$405	$180	$585	7.1
314A, Study Room	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
314B, Study Room	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
314C, Study Room	3	2	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$135	$60	$195	7.1
314D, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
314E, Seminar	8	4	40	223	893	1,340	10	159	638	957	7.0	$399	141	563	845	6.2	100	402	603	4.4	$252	$400	$160	$560	3.8
314F, A.D.P. Room	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
314G, Study Room	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
314H, Study Room	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
314I, Study Room	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
314J, Study Room	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
314K, Study Room	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
314L, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
314M, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$150	$60	$210	3.8
314N, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$150	$60	$210	3.8
314O, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
314R, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$50	$20	$70	3.8
314S, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$50	$20	$70	3.8
314U, Study Room	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
314V, Study Room	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
315, Mechanical Room	6	2	40		335	502	4		239	359	2.6	$144		211	316	2.3		151	226	1.6	$91	$270	$120	$390	7.3
Open Areas & Corridors	43	2	40	600	2,400	3,600	26	429	1,714	2,571	18.8	$1,073	378	1,513	2,270	16.6	270	1,081	1,621	11.9	$676	$1,935	$860	$2,795	7.0
Open Areas & Corridors	5	1	40	35	140	209	2	25	100	150	1.1	$62	22	88	132	0.9	16	63	95	0.7	$39	$213	$100	$313	13.6
Clerestory	15	2	40	209	837	1,256	9	150	598	897	6.6	$375	132	528	792	5.8	95	377	566	4.2	$236	$675	$300	$975	7.0
AHU-6																									
Second Floor:																									
214, Library	619	2	40	8,637	34,548	51,823	379	6,169	24,677	37,016	270.5	$15,442	5,445	21,780	32,671	238.7	3,889	15,557	23,336	170.5	$9,735	$15,475	$12,380	$27,855	4.9
214, Library	101	1	40	705	2,819	4,228	31	503	2,013	3,020	22.1	$1,260	444	1,777	2,665	19.5	317	1,269	1,904	13.9	$795	$4,293	$2,020	$6,313	13.6
215, Study Room	2	3	40		167	251	2		120	179	1.3	$72		105	158	1.1		76	113	0.8	$45	$95	$40	$135	5.1
216, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
217, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
218, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
219, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
220, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
221, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
222, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
223, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
224, Men's Room	4	2	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$180	$80	$260	7.1
226, Copy Room	1	2	40	14	56	84	1	10	40	60	0.4	$24	9	35	53	0.4	6	25	38	0.3	$15	$45	$20	$65	7.2
227, Women's Room	4	2	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$180	$80	$260	7.1
230, Mechanical	9	2	40		502	753	6		359	538	3.9	$216		316	475	3.5		226	339	2.5	$136	$405	$180	$585	7.3
231, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
232, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
233, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
234, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
235, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
236, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
237, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
238, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
239, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
240, Study Room	1	3	40		84	126	1		60	90	0.7	$37		53	79	0.6		38	57	0.4	$23	$48	$20	$68	5.0
241, Storage	2	2	40		112	167	1		80	120	0.9	$49		71	105	0.8		50	76	0.6	$31	$90	$40	$130	7.3
248, Sorting Room	2	3	40		167	251	2		120	179	1.3	$72		105	158	1.1		76	113	0.8	$45	$95	$40	$135	5.1
Third Floor:																									
316A, Office Area	11	4	40	307	1,228	1,842	14	219	877	1,316	9.6	$549	194	774	1,161	8.5	138	553	830	6.1	$346	$550	$220	$770	3.8
316B, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
316C, Processing	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
316D, Vault	18	2	40		1,005	1,507	11		718	1,076	7.9	$434		634	950	6.9		453	678	5.0	$274	$810	$360	$1,170	7.3
316E, Reading Room	6	4	40		670	1,005	7		478	718	5.2	$288		422	634	4.6		301	453	3.3	$182	$300	$120	$420	3.9
316E-2, Corridor	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
316F, Reading Room	16	4	40		1,786	2,679	20		1,276	1,914	14.0	$771		1,126	1,689	12.4		804	1,207	8.8	$486	$800	$320	$1,120	3.9
316G, Reading Room	9	4	40		1,005	1,507	11		718	1,076	7.9	$434		634	950	6.9		453	678	5.0	$274	$450	$180	$630	3.9
319, Special Collections & His	38	1	40	265	1,060	1,591	12	189	757	1,136	8.3	$474	167	668	1,003	7.3	119	477	716	5.2	$299	$855	$760	$1,615	9.2
319A, Office Area	4	2	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$180	$80	$260	7.1
319B, Conserv. Lab	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$300	$120	$420	3.8
319E, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$100	$40	$140	3.8
320, Staff Room	4	4	40		447	670	5		319	478	3.5	$193		282	422	3.1		201	301	2.2	$122	$200	$80	$280	3.9
324, Secure Room	4	4	40		447	670	5		319	478	3.5	$193		282	422	3.1		201	301	2.2	$122	$200	$80	$280	3.9
325, Mail	3	4	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$150	$60	$210	3.8
326, Office Area	22	4	40	614	2,456	3,684	27	439	1,754	2,631	19.2	$1,097	387	1,548	2,323	17.0	277	1,106	1,659	12.1	$692	$1,100	$440	$1,540	3.8
326A, Secure Storage	1	2	40		56	84	1		40	60	0.4	$23		35	53	0.4		25	38	0.3	$15	$45	$20	$65	7.5
326B, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$50	$20	$70	3.8
326C, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$50	$20	$70	3.8
327A, Mechanical Room	4	2	40		223	335	2		159	239	1.7	$95		141	211	1.5		100	151	1.1	$60	$180	$80	$260	7.4
328, Men's Room	4	2	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$180	$80	$260	7.1
329, Women's Room	4	1	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$170	$80	$250	13.5
330, Corridor	4	2	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$180	$80	$260	7.1
AHU-7																									
Ground Floor:																									
154, Kitchen	23	4	40	1,284	2,567	3,851	28	917	1,834	2,751	20.1	$1,187	809	1,618	2,428	17.7	578	1,156	1,734	12.7	$748	$1,150	$460	$1,610	3.7
154A, Office	2	2	40	56	112	167	1	40	80	120	0.9	$52	35	71	105	0.8	25	50	76	0.6	$33	$90	$40	$130	6.8
154B, Office	2	2	40	56	112	167	1	40	80	120	0.9	$52	35	71	105	0.8	25	50	76	0.6	$33	$90	$40	$130	6.8
154F, Cafeteria	144	1	40	2,009	4,019	6,028	44	1,435	2,870	4,306	31.5	$1,858	1,267	2,534	3,800	27.7	905	1,809	2,715	19.9	$1,171	$3,240	$2,880	$6,120	8.9
AHU-8																									
Ground Floor:																									
100, Mechanical Room	6	2	40		335	502	4		239	359	2.6	$144		211	316	2.3		151	226	1.6	$91	$270	$120	$390	7.3
(Passageway)	2	2	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$90	$40	$130	7.0
101, Classroom	11	2	40	153	614	921	7	110	439	658	4.8	$274	96	387	581	4.2	69	277	415	3.0	$173	$495	$220	$715	7.1
102, Classroom	11	2	40	153	614	921	7	110	439	658	4.8	$274	96	387	581	4.2	69	277	415	3.0	$173	$495	$220	$715	7.1
103, Seminar	24	2	40	335	1,340	2,009	15	239	957	1,435	10.5	$599	211	845	1,267	9.3	151	603	905	6.6	$378	$1,080	$480	$1,560	7.0
104, Seminar	26	2	40	363	1,451	2,177	16	259	1,037	1,555	11.4	$649	229	915	1,372	10.0	163	654	980	7.2	$409	$1,170	$520	$1,690	7.0

4' T-8 R[illegible]

Room or Area Description	N[illegible] Of Lum.	[illegible] Lum	Watts Per Lamp	Existing Non-Summer Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Existing Summer Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Off-[illegible] Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Material $	Labor $	[illegible]tal $	Payback Yrs
105, Seminar	20	2	40	279	1,116	1,674	12	199	797	1,196	8.7	$498	176	704	1,055	7.7	125	502	754	5.5	$314	$900	$400	$1,300	7.1
106, Classroom	24	2	40	335	1,340	2,009	15	239	957	1,435	10.5	$599	211	845	1,267	9.3	151	603	905	6.6	$378	$1,080	$480	$1,560	7.0
107, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
108, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
109, Corridor	13	2	40	181	726	1,088	8	130	518	777	5.7	$325	114	458	686	5.0	82	327	490	3.6	$205	$585	$260	$845	7.0
110, Classroom	10	2	40	140	558	837	6	100	399	598	4.4	$250	88	352	528	3.8	63	252	377	2.8	$158	$450	$200	$650	7.0
111, Classroom	10	2	40	140	558	837	6	100	399	598	4.4	$250	88	352	528	3.8	63	252	377	2.8	$158	$450	$200	$650	7.0
113, Security Desk	2	4	40	982	447	447	2	702	319	319	1.7	$184	619	282	282	1.5	443	201	201	1.1	$116	$100	$40	$140	2.1
Second Floor:																									
200, Mechanical Room	6	2	40		335	502	4		239	359	2.6	$144		211	316	2.3		151	226	1.6	$91	$270	$120	$390	7.3
201, Rec./Work	24	4	40	670	2,679	4,019	29	478	1,914	2,870	21.0	$1,198	422	1,689	2,534	18.5	301	1,207	1,809	13.2	$755	$1,200	$480	$1,680	3.8
201A, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$190	$80	$270	4.9
201B, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$190	$80	$270	4.9
201C, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
201D, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$50	$20	$70	3.8
201E, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	18	71	105	0.8	13	50	76	0.6	$32	$50	$20	$70	3.8
201F, Conference	4	4	40		447	670	5		319	478	3.5	$193		282	422	3.1		201	301	2.2	$122	$200	$80	$280	3.9
201G, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
201H, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
201I, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
202, Office	6	3	40	126	502	753	6	90	359	538	3.9	$224	79	316	475	3.5	57	226	339	2.5	$141	$285	$120	$405	4.9
203, Office Area	24	3	40	502	2,009	3,014	22	359	1,435	2,153	15.7	$897	316	1,267	1,900	13.9	226	905	1,357	9.9	$566	$1,140	$480	$1,620	4.9
203B, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$190	$80	$270	4.9
203C, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$190	$80	$270	4.9
203D, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$190	$80	$270	4.9
Third Floor:																									
300, Mechanical Room	6	2	40		335	502	4		239	359	2.6	$144		211	316	2.3		151	226	1.6	$91	$270	$120	$390	7.3
301, Office Area	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$300	$120	$420	3.8
301A, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$190	$80	$270	4.9
301B, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
301C, Storage	2	4	40		223	335	2		159	239	1.7	$95		141	211	1.5		100	151	1.1	$60	$100	$40	$140	4.0
305, Corridor & Copy Area	12	2	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$540	$240	$780	7.1
305, Corridor & Copy Area	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
305A, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
305B, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
305C, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	40	158	238	1.8	28	113	170	1.3	$71	$143	$60	$203	4.8
306, Operations	8	3	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$380	$160	$540	4.9
306A, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$190	$80	$270	4.9
306B, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	53	211	316	2.3	38	151	226	1.6	$94	$190	$80	$270	4.9
306C	1	2	40	14	56	84	1	10	40	60	0.4	$24	9	35	53	0.4	6	25	38	0.3	$15	$45	$20	$65	7.2
307, Office Area	11	4	40	307	1,228	1,842	14	219	877	1,316	9.6	$549	194	774	1,161	8.5	138	553	830	6.1	$346	$550	$220	$770	3.8
307A, Office	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$300	$120	$420	3.8
307A, Office	1	2	40	14	56	84	1	10	40	60	0.4	$24	9	35	53	0.4	6	25	38	0.3	$15	$45	$20	$65	7.2
307B, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	26	105	158	1.1	19	76	113	0.8	$47	$95	$40	$135	4.9
307C, Closet	4	3	40		335	502	4		239	359	2.6	$144		211	316	2.3		151	226	1.6	$91	$190	$80	$270	5.1
308, Ceremonial Room	5	2	40		279	419	3		199	299	2.2	$121		176	264	2.0		125	189	1.4	$76	$225	$100	$325	7.3
308, Ceremonial Room	2	3	40		167	251	2		120	179	1.3	$72		105	158	1.1		76	113	0.8	$45	$95	$40	$135	5.1
AC-2																									
Ground Floor:																									
169B, Office	1	3	40	21	84	126	1	15	60	90	0.7	$38	13	53	79	0.6	9	38	57	0.4	$24	$48	$20	$68	4.8
AC-3																									
Third Floor:																									
333C, Computer Room	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
AC-4																									
Ground Floor:																									
152A, Computer Room	10	4	40	279	1,116	1,674	12	199	797	1,196	8.7	$498	176	704	1,055	7.7	125	502	754	5.5	$314	$500	$200	$700	3.8
FC-1																									
Third Floor:																									
313C, Seminar	20	2	40	279	1,116	1,674	12	199	797	1,196	8.7	$498	176	704	1,055	7.7	125	502	754	5.5	$314	$900	$400	$1,300	7.1
FC-2																									
Third Floor:																									
313B, Office	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$300	$120	$420	3.8
(Passageway)	4	2	40	56	223	335	2	40	159	239	1.7	$99	35	141	211	1.5	25	100	151	1.1	$62	$180	$80	$260	7.1
FC-3																									
Third Floor:																									
313, Reception	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
313, Reception	1	2	40	14	56	84	1	10	40	60	0.4	$24	9	35	53	0.4	6	25	38	0.3	$15	$45	$20	$65	7.2
FC-4																									
Third Floor:																									
313A, Office	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	105	422	634	4.6	76	301	453	3.3	$188	$300	$120	$420	3.8
MISC.																									
Ground Floor:																									
192, Security	2	3	40	737	335	335	2	526	239	239	1.3	$138	465	211	211	1.1	332	151	151	0.8	$87	$95	$40	$135	2.6
192, Security	1	2	40	246	112	112	1	175	80	80	0.4	$46	155	71	71	0.4	110	50	50	0.3	$29	$45	$20	$65	3.9
168, Corridor	16	2	40	223	893	1,340	10	159	638	957	7.0	$399	141	563	845	6.2	100	402	603	4.4	$252	$720	$320	$1,040	7.0
169, Mechanical Room	16	2	40		893	1,340	10		638	957	7.0	$386		563	845	6.2		402	603	4.4	$243	$720	$320	$1,040	7.3
169A, Boiler Room	9	2	40		502	753	6		359	538	3.9	$216		316	475	3.5		226	339	2.5	$136	$405	$180	$585	7.3
Third Floor:																									
319D, Vault/Stacks	43	2	40		2,400	3,600	26		1,714	2,571	18.8	$1,036		1,513	2,270	16.6		1,081	1,621	11.9	$653	$1,935	$860	$2,795	7.3
333C, Computer Room	4	4	40	112	447	670	5	80	319	478	3.5	$200	71	282	422	3.1	50	201	301	2.2	$126	$200	$80	$280	3.8
Penthouse:																									
Mech/Elec. Room	15	2	40		837	1,256	9		598	897	6.6	$362		528	792	5.8		377	566	4.2	$228	$675	$300	$975	7.3
Stairwells:																									
Stairwell #1	3	2	40	737	335	335	2	526	239	239	1.3	$138	465	211	211	1.1	332	151	151	0.8	$87	$135	$60	$195	3.8
Stairwell #2	7	2	40	1,719	781	781	4	1,228	558	558	3.1	$325	1,084	492	492	2.7	774	352	352	2.0	$205	$315	$140	$455	3.8
Stairwell #3	6	2	40	1,473	670	670	4	1,052	478	478	2.6	$278	929	422	422	2.3	663	301	301	1.6	$175	$270	$120	$390	3.8
Stairwell #4	6	2	40	1,473	670	670	4	1,052	478	478	2.6	$278	929	422	422	2.3	663	301	301	1.6	$175	$270	$120	$390	3.8
Stairwell #5	3	2	40	737	335	335	2	526	239	239	1.3	$138	465	211	211	1.1	332	151	151	0.8	$87.29	$135	$60	$195	3.8
Sub-totals	3,083			59,999	210,278	313,630	2,277	42,871	150,186	224,019	1,627	$93,800	37,825	132,567	197,723	1,436	27,027	94,682	141,229	1,026	$59,100	$125,900	$61,700	$187,600	5.4

Columns 14–22 are under a spanning header that is obscured on the scan ([illegible]).

Number of Lamps	7,458
Number of Ballasts	4,112

Non-Summer Incrementals

Winter Incremental Demand Cost $/Kw	$6.60
Off-Peak Incremental Usage Cost $/Kw	$0.0370
Intermediate Incremental Usage Cost $/	$0.0460

Summer Incrementals

Winter Incremental Demand Cost $/Kw	$17.09
Off-Peak Incremental Usage Cost $/Kwh	$0.0340
Intermediate Incremental Usage Cost $/K	$0.0470

ECO-10
Reflectors

Existing. Presently, Marshall Hall utilizes approximately 3,652 fluorescent luminaires that contain four and three lamps. The luminaires are generally located in office and administration areas and typically provide illumination levels between 50 and 60 foot candles. A substantial amount of the areas contain desk lamps and have luminaires served from two circuits (inner lamps and outer lamps on separate switches). However, during site investigations it was found that most of the areas had all lamps energized as well as desk lights.

For the most part these areas require only general illumination levels of approximately 30 to 40 foot candles. The attached table lists areas which Entech has determined to fall into these categories. From the attached sheets, the annual electric demand for these areas is 1,718 kW and usage is 481,443 kWh. The annual costs for the existing lights are $45,100. All quantities have been developed from the light model and are calculated in the attachment. The table below summarizes the estimates:

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	1,099	30,126	100,771	149,954	$20,950
Summer	785	21,528	71,969	107,096	$24,170
Totals	1,884	51,654	172,740	257,050	$45,100

Proposed. Three lamped luminaires will have one lamp and one ballast removed while two lamped luminaires will have two lamps and one ballast removed. All luminaires will receive new high reflectivity specular aluminum reflectors. Generally delamping alone provides a 10% increase in relative light output. When combined with reflectors, relative light output can increase more than 15%. Entech expects illuminance levels between 30 and 40 foot candles. When combined with task lights these levels will be adequate. Removing lamps and ballast in these luminaires will reduce energy usage approximately 45% as calculated on the following page. This project is expected to lower annual demand and usage to 1,062 kW and 272,249 kWh. Annual electric cost for these luminaires will become $25,500. The attached table list calculations by area and are summarized below.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	619	17,527	56,798	84,490	$11,820
Summer	443	12,525	40,567	60,342	$13,640
Totals	1,062	30,052	97,365	144,832	$25,500

Construction Cost. The expected construction cost for this project will be $137,900. (reference attached data sheet).

Material	$ 82,200
Labor	$ 41,100
Engineering	$ 14,600

Savings. The annual cost savings resulting from the implementation of this project will be $19,600 ($45,100 - $25,500).

Non-Summer kW = 480 kW/yr (1,099 kW/yr - 619 kW/yr)

Summer kW = 342 kW/yr (785 kW/yr - 443 kW/yr)

Off-Peak kWh = 21,602 kWh/yr (51,654 kWh/yr - 30,052 kWh/yr)

Intermediate kWh = 75,375 kWh/yr (172,740 kWh/yr - 97,365 kWh/yr)

On-Peak kWh = 112,218 kWh/yr (257,050 kWh/yr - 144,832 kWh/yr)

Energy Usage = 714 mmBtu/yr ((21,602 kWh + 75,375 kWh + 112,218 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu

Btu/sf = 2,933 Btu/sf ((21,602 kWh + 75,375 kWh + 112,218 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion. The expected payback resulting from the implementation of this project is 7.0 years ($137,900 ÷ $19,600). The retrofit is estimated to provide a reduction in cooling costs and not increase heating costs.

Cooling Savings, 5 Summer Months

Description	Light Savings	Equiv Cool @ 5 cop	Cost Savings
Off-Peak, kWh	9,001	1,800	$61
Intermediate, kWh	31,406	6,281	$295
On-Peak, kWh	31,406	6,281	$389
Demand, kW	342	68	$1,169
Total			$1,900

The retrofit will decrease HVAC cost by $2,200. Thus the simple payback for this project will decrease to 6.1 years ($138,000 ÷ ($20,300 + $2,200)). This ECO is calculated on a stand-alone basis. If the T-8 retrofit is completed this ECO's cost will change. Interaction of ECOs will be addressed in the Conclusion Section. There is no additional monetary savings to reduce maintenance.

Delamp W ectors

	No.	Lamps	Watts	Existing Non-Summer Annual Totals				Existing Summer Annual Totals					Proposed Annual Totals												
Room or Area Description	Of Lum.	Per Lum	Per Lamp	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Material $	Labor $	Total $	Payback Yrs
AHU-1N & AHU-1S																									
Ground Floor:																									
170, Workroom	21	3	32		1,758	2,637	19.3		1,256	1,884	13.8	$760		1,172	1,758	12.9		837	1,256	9.2	$506	$1,680	$840	$2,520	10.0
170A, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
170B, Conference	3	3	32		126	126	3		90	90	1.9	$72		84	84	1.7		60	60	1.3	$48	$240	$120	$360	15.0
173, Mail Room	11	3	32	230	921	1381	10	164	658	987	7.2	$411	153	614	921	6.7	109	439	658	4.8	$274	$880	$440	$1,320	9.6
173A, Office	1	3	32	21	84	126	1	15	60	90	0.7	$38	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	9.4
174, Pick Up	6	3	32	126	502	753	6	90	359	538	3.9	$224	84	335	502	3.7	60	239	359	2.6	$149	$480	$240	$720	9.6
174A, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
174B, Office Area	9	3	32	188	753	1,130	8	135	538	807	5.9	$337	125	502	753	5.5	90	359	538	3.9	$225	$720	$360	$1,080	9.6
174C, Office	4	3	32	84	335	502	4	60	239	359	2.6	$150	56	223	335	2.5	40	159	239	1.7	$100	$320	$160	$480	9.6
174D, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
181, Print Work Room	21	4	32	586	2,344	3,516	26	419	1,674	2,512	18.4	$1,049	293	1,172	1,758	12.9	210	837	1,256	9.2	$524	$1,680	$840	$2,520	4.8
181F, Janitor's Closet	1	3	32	21	84	126	1	15	60	90	0.7	$38	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	9.4
181G, Porox. Camera	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
181H, Color Room	3	4	32	84	335	502	4	60	239	359	2.6	$150	42	168	251	1.9	30	120	180	1.3	$75	$240	$120	$360	4.8
181I, Pick Up Room	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
181J, Camera Room	1	4	32	28	112	167	1	20	80	120	0.9	$50	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	4.8
181K, Slide Mounting	1	4	32	28	112	167	1	20	80	120	0.9	$50	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	4.8
181L, Film Viewing	1	4	32	28	112	167	1	20	80	120	0.9	$50	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	4.8
183A, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
183B, A.V. Control	6	4	32	167	670	1,005	7	120	478	718	5.2	$298	84	335	503	3.7	60	239	359	2.6	$149	$480	$240	$720	4.8
183E, Typesetting	8	3	32	167	670	1,005	7	120	478	718	5.2	$298	111	447	670	4.9	80	319	479	3.5	$199	$640	$320	$960	9.7
183E-2, Office	1	4	32	28	112	167	1	20	80	120	0.9	$50	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	4.8
183F, Graphic Arts	20	3	32	419	1,674	2,512	18	299	1,196	1,794	13.1	$749	279	1,116	1,675	12.3	199	797	1,196	8.7	$499	$1,600	$800	$2,400	9.6
183F-2, Work Room	12	4	32	335	1,340	2,009	15	239	957	1,435	10.5	$599	168	670	1,005	7.4	120	479	718	5.3	$300	$960	$480	$1,440	4.8
183G, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
183H, Conference	4	4	32		447	670	5		319	478	3.5	$193		224	335	2.5		160	239	1.8	$96	$320	$160	$480	5.0
183I, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
183J, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
183K, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
183L, Printing	27	4	32	753	3,014	4,521	33	538	2,153	3,229	23.6	$1,347	377	1,507	2,261	16.5	269	1,077	1,615	11.8	$673	$2,160	$1,080	$3,240	4.8
183M, Pick Up Room	4	3	32	84	335	502	4	60	239	359	2.6	$150	56	223	335	2.5	40	159	239	1.7	$100	$320	$160	$480	9.6
183N, Files	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
183O, Office Area	7	3	32	147	586	879	6	105	419	628	4.6	$262	98	391	586	4.3	70	279	419	3.1	$175	$560	$280	$840	9.6
198B, Security Desk	3	3	32	1,105	502	502	3	789	359	359	2.0	$209	737	335	335	1.9	526	239	239	1.3	$139	$240	$120	$360	5.2
AHU-3																									
Ground Floor:																									
185, A.V. Room	10	3	32		837	1,256	9		598	897	6.6	$362		558	837	6.1		399	598	4.4	$242	$800	$400	$1,200	9.9
188, Office Area	22	3	32	460	1,842	2,763	20	329	1,316	1,973	14.4	$823	307	1,228	1,842	13.5	219	877	1,315	9.6	$549	$1,760	$880	$2,640	9.6
188A, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
194, Holding	2	3	32		167	251	2		120	179	1.3	$72		111	167	1.2		80	119	0.9	$48	$160	$80	$240	10.0
Second Floor:																									
242, Reading Room	8	4	32		893	1,340	10		638	957	7.0	$386		447	670	4.9		319	479	3.5	$193	$640	$320	$960	5.0
243, Group Viewing	12	3	32		1,005	1,507	11		718	1,076	7.9	$434		670	1,005	7.3		479	717	5.3	$289	$960	$480	$1,440	10.0
245, Office Area	27	4	32	753	3,014	4,521	33	538	2,153	3,229	23.6	$1,347	377	1,507	2,261	16.5	269	1,077	1,615	11.8	$673	$2,160	$1,080	$3,240	4.8
245A, Work Room	5	3	32	105	419	628	5	75	299	449	3.3	$188	70	279	419	3.1	50	199	299	2.2	$125	$400	$200	$600	9.6
245B, Office	1	4	32	28	112	167	1	20	80	120	0.9	$50	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	4.8
245C, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
245D, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
246, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
Third Floor:																									
331, Conference	6	4	32		335	335	4		239	239	2.8	$133		168	168	2.0		120	120	1.4	$66	$480	$240	$720	10.8
332, Conference	6	4	32		335	335	4		239	239	2.8	$133		168	168	2.0		120	120	1.4	$66	$480	$240	$720	10.8
333, Office Area	18	3	32	377	1,507	2,260	17	269	1,076	1,615	11.8	$673	251	1,005	1,507	11.0	179	717	1,077	7.9	$449	$1,440	$720	$2,160	9.6
333A, Office	3	4	32	84	335	502	4	60	239	359	2.6	$150	42	168	251	1.9	30	120	180	1.3	$75	$240	$120	$360	4.8
333B, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
AHU-5																									
Ground Floor:																									
119, Office	3	4	32	84	335	502	4	60	239	359	2.6	$150	42	168	251	1.9	30	120	180	1.3	$75	$240	$120	$360	4.8
120, Office	3	4	32	84	335	502	4	60	239	359	2.6	$150	42	168	251	1.9	30	120	180	1.3	$75	$240	$120	$360	4.8
121, Office	3	4	32	84	335	502	4	60	239	359	2.6	$150	42	168	251	1.9	30	120	180	1.3	$75	$240	$120	$360	4.8
122, Open Office Area	6	4	32	167	670	1,005	7	120	478	718	5.2	$298	84	335	503	3.7	60	239	359	2.6	$149	$480	$240	$720	4.8
124, Office	3	4	32	84	335	502	4	60	239	359	2.6	$150	42	168	251	1.9	30	120	180	1.3	$75	$240	$120	$360	4.8
125, Passageway	1	3	32	21	84	126	1	15	60	90	0.7	$38	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	9.4
126, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
127, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
128, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
129, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
130, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
131, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
132, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
133, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
134, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
135, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
136, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
137, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
138, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
139, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
140, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
141, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
142, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
143, Mail Room	3	4	32	84	335	502	4	60	239	359	2.6	$150	42	168	251	1.9	30	120	180	1.3	$75	$240	$120	$360	4.8
144, Office	4	3	32	84	335	502	4	60	239	359	2.6	$150	56	223	335	2.5	40	159	239	1.7	$100	$320	$160	$480	9.6
144A, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
144B, Office	6	4	32	167	670	1,005	7	120	478	718	5.2	$298	84	335	503	3.7	60	239	359	2.6	$149	$480	$240	$720	4.8
144C, Office	6	4	32	167	670	1,005	7	120	478	718	5.2	$298	84	335	503	3.7	60	239	359	2.6	$149	$480	$240	$720	4.8
145, Office	8	3	32	167	670	1,005	7	120	478	718	5.2	$298	111	447	670	4.9	80	319	479	3.5	$199	$640	$320	$960	9.7
146, Office	4	4	32	112	447	670	5	80	319	478	3.5	$200	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
147, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
148, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
149, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
150, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
151, Office	3	4	32	84	335	502	4	60	239	359	2.6	$150	42	168	251	1.9	30	120	180	1.3	$75	$240	$120	$360	4.8
152, Library/Class	10	4	32	279	1,116	1,674	12	199	797	1,196	8.7	$498	140	558	837	6.1	100	399	598	4.4	$249	$800	$400	$1,200	4.8
152B, Open Office Area/Corridor	12	4	32	335	1,340	2,009	15	239	957	1,435	10.5	$599	168	670	1,005	7.4	120	479	718	5.3	$300	$960	$480	$1,440	4.8
Second Floor:																									
209, Office Area	12	3	32	251	1,005	1,507	11	179	718	1,076	7.9	$450	167	670	1,005	7.3	119	479	717	5.3	$300	$960	$480	$1,440	9.6
209A, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
209B, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9

Delamp W[illegible]ectors

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Existing Non-Summer Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Existing Summer Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Proposed Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Material $	Labor $	Total $	Payback Yrs
209C, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
209D, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
209E, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
209F, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
209H, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
209I, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
209J, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
209L, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
209M, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
209N, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
209O, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
209P, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
209Q, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
210, Office	8	3	32	167	670	1,005	7	120	478	718	5.2	$298	111	447	670	4.9	80	319	479	3.5	$199	$640	$320	$960	9.7
210A, Pick Up	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
210B, Office	4	4	32	112	447	670	5	80	319	478	3.5	$200	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
210C, Office	8	3	32	167	670	1,005	7	120	478	718	5.2	$298	111	447	670	4.9	80	319	479	3.5	$199	$640	$320	$960	9.7
210D, Office	4	4	32	112	447	670	5	80	319	478	3.5	$200	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
210E, Office	4	4	32	112	447	670	5	80	319	478	3.5	$200	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
210F, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
210G, Office	1	4	32	28	112	167	1	20	80	120	0.9	$50	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	4.8
210H, Office	6	4	32	167	670	1,005	7	120	478	718	5.2	$298	84	335	503	3.7	60	239	359	2.6	$149	$480	$240	$720	4.8
211, Security	17	3	32	6,262	1,423	2,135	16	4,473	1,017	1,525	11.1	$997	4,175	949	1,423	10.4	2,982	678	1,017	7.4	$665	$1,360	$680	$2,040	6.1
211A, Office	6	3	32	126	502	753	6	90	359	538	3.9	$224	84	335	502	3.7	60	239	359	2.6	$149	$480	$240	$720	9.6
211B, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
211C, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
211D, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
212, Office Area	10	4	32	279	1,116	1,674	12	199	797	1,196	8.7	$498	140	558	837	6.1	100	399	598	4.4	$249	$800	$400	$1,200	4.8
212A, Biofeedback	6	4	32	167	670	1,005	7	120	478	718	5.2	$298	84	335	503	3.7	60	239	359	2.6	$149	$480	$240	$720	4.8
212C, Office	3	4	32	84	335	502	4	60	239	359	2.6	$150	42	168	251	1.9	30	120	180	1.3	$75	$240	$120	$360	4.8
212D, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
212E, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
212F, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
212G, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
212H, Office	4	4	32	112	447	670	5	80	319	478	3.5	$200	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
212I, Office	4	4	32	112	447	670	5	80	319	478	3.5	$200	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
Third Floor:			32																						
309, Office Area	10	3	32	209	837	1,256	9	150	598	897	6.6	$375	139	558	837	6.1	100	399	598	4.4	$250	$800	$400	$1,200	9.6
309A, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
309B, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
309C, Office	5	4	32	140	558	837	6	100	399	598	4.4	$250	70	279	419	3.1	50	200	299	2.2	$125	$400	$200	$600	4.8
309D, Storage	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
314, Office Area	26	4	32	726	2,902	4,353	32	518	2,073	3,110	22.7	$1,297	363	1,451	2,177	15.9	259	1,037	1,555	11.4	$648	$2,080	$1,040	$3,120	4.8
314A, Study Room	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
314B, Study Room	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
314D, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
314E, Seminar	8	4	32	223	893	1,340	10	159	638	957	7.0	$399	112	447	670	4.9	80	319	479	3.5	$200	$640	$320	$960	4.8
314F, A.D.P. Room	4	4	32	112	447	670	5	80	319	478	3.5	$200	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
314G, Study Room	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
314H, Study Room	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
314I, Study Room	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
314J, Study Room	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
314K, Study Room	4	4	32	112	447	670	5	80	319	478	3.5	$200	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
314L, Office	4	4	32	112	447	670	5	80	319	478	3.5	$200	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
314M, Office	3	4	32	84	335	502	4	60	239	359	2.6	$150	42	168	251	1.9	30	120	180	1.3	$75	$240	$120	$360	4.8
314N, Office	3	4	32	84	335	502	4	60	239	359	2.6	$150	42	168	251	1.9	30	120	180	1.3	$75	$240	$120	$360	4.8
314O, Office	4	4	32	112	447	670	5	80	319	478	3.5	$200	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
314P, Electrical Closet	1	3	32		8	8	0		6	6	0.0			5	5			4	4						
314Q, Telephone Closet	1	3	32		8	8	0		6	6	0.0			5	5			4	4						
314R, Office	1	4	32	28	112	167	1	20	80	120	0.9	$50	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	4.8
314S, Office	1	4	32	28	112	167	1	20	80	120	0.9	$50	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	4.8
314U, Study Room	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
314V, Study Room	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
AHI-6																									
Second Floor.																									
215, Study Room	2	3	32		167	251	2		120	179	1.3	$72		111	167	1.2		80	119	0.9	$48	$160	$80	$240	10.0
216, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
217, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
218, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
219, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
220, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
221, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
222, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
223, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
231, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
232, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
233, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
234, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
235, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
236, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
237, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
238, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
239, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
240, Study Room	1	3	32		84	126	1		60	90	0.7	$37		56	84	0.6		40	60	0.5	$25	$80	$40	$120	9.8
248, Sorting Room	2	3	32		167	251	2		120	179	1.3	$72		111	167	1.2		80	119	0.9	$48	$160	$80	$240	10.0
Third Floor:																									
316A, Office Area	11	4	32	307	1,228	1,842	14	219	877	1,316	9.6	$549	154	614	921	6.8	110	439	658	4.8	$274	$880	$440	$1,320	4.8
316B, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
316C, Processing	2	3	32	42	167	251	2	30	120	179	1.3	$74	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
316E, Reading Room	6	4	32		670	1,005	7		478	718	5.2	$288		335	503	3.7		239	359	2.6	$144	$480	$240	$720	5.0
316E-2, Corridor	4	4	32	112	447	670	5	80	319	478	3.5	$200	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
316F, Reading Room	16	4	32		1,786	2,679	20		1,276	1,914	14.0	$771		893	1,340	9.8		638	957	7.0	$386	$1,280	$640	$1,920	5.0
316G, Reading Room	9	4	32		1,005	1,507	11		718	1,076	7.9	$434		503	754	5.5		359	538	4.0	$217	$720	$360	$1,080	5.0
319B, Conserv. Lab	6	4	32	167	670	1,005	7	120	478	718	5.2	$298	84	335	503	3.7	60	239	359	2.6	$149	$480	$240	$720	4.8
319E, Office	2	4	32	56	223	335	2	40	159	239	1.7	$99	28	112	168	1.2	20	80	120	0.9	$49	$160	$80	$240	4.9
320, Staff Room	4	4	32		447	670	5		319	478	3.5	$193		224	335	2.5		160	239	1.8	$96	$320	$160	$480	5.0
324, Secure Room	4	4	32		447	670	5		319	478	3.5	$193		224	335	2.5		160	239	1.8	$96	$320	$160	$480	5.0
325, Mail	3	4	32	84	335	502	4	60	239	359	2.6	$150	42	168	251	1.9	30	120	180	1.3	$75	$240	$120	$360	4.8
326, Office Area	22	4	32	614	2,456	3,684	27	439	1,754	2,631	19.2	$1,097	307	1,228	1,842	13.5	220	877	1,316	9.6	$549	$1,760	$880	$2,640	4.8
326B, Office	1	4	32	28	112	167	1	20	80	120	0.9	$50	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	4.8

Delamp W[illegible]ctors

Room or Area Description	No. Of Lum.	Lamps Per Lum.	Watts Per Lamp	Existing Non-Summer Annual Totals Off-Peak Kwh	Inter. Kwh	On Peak Kwh	Winter kW	Existing Summer Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
326C, Office	1	4	32	28	112	167	1	20	80	120	0.9	$50
AHU-7												
Ground Floor:												
154, Kitchen	23	4	32	1,284	2,567	3,851	28	917	1,834	2,751	20.1	$1,187
AHU-8												
Ground Floor:												
107, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113
108, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113
113, Security Desk	2	4	32	982	447	447	2	702	319	319	1.7	$184
Second Floor:												
201, Rec./Work	24	4	32	670	2,679	4,019	29	478	1,914	2,870	21.0	$1,198
201A, Office	4	3	32	84	335	502	4	60	239	359	2.6	$150
201B, Office	4	3	32	84	335	502	4	60	239	359	2.6	$150
201C, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74
201D, Office	1	4	32	28	112	167	1	20	80	120	0.9	$50
201E, Office	1	4	32	28	112	167	1	20	80	120	0.9	$50
201F, Conference	4	4	32		447	670	5		319	478	3.5	$193
201G, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113
201H, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74
201I, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74
202, Office	6	3	32	126	502	753	6	90	359	538	3.9	$224
203, Office Area	24	3	32	502	2,009	3,014	22	359	1,435	2,153	15.7	$897
203A, Conference	4	3	32		167	167	2		120	120	1.4	$66
203B, Office	4	3	32	84	335	502	4	60	239	359	2.6	$150
203C, Office	4	3	32	84	335	502	4	60	239	359	2.6	$150
203D, Office	4	3	32	84	335	502	4	60	239	359	2.6	$150
Third Floor:												
301, Office Area	6	4	32	167	670	1,005	7	120	478	718	5.2	$298
301A, Office	4	3	32	84	335	502	4	60	239	359	2.6	$150
301B, Office	4	4	32	112	447	670	5	80	319	478	3.5	$200
301C, Storage	2	4	32		223	335	2		159	239	1.7	$95
302, Conference Room	6	3	32		251	251	3		179	179	2.1	$99
303, Conference Room	6	3	32		251	251	3		179	179	2.1	$99
305, Corridor & Copy Area	4	4	32	112	447	670	5	80	319	478	3.5	$200
305A, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74
305B, Office	4	4	32	112	447	670	5	80	319	478	3.5	$200
305C, Office	3	3	32	63	251	377	3	45	179	269	2.0	$113
306, Operations	8	3	32	167	670	1,005	7	120	478	718	5.2	$298
306A, Office	4	3	32	84	335	502	4	60	239	359	2.6	$150
306B, Office	4	3	32	84	335	502	4	60	239	359	2.6	$150
307, Office Area	11	4	32	307	1,228	1,842	14	219	877	1,316	9.6	$549
307A, Office	6	4	32	167	670	1,005	7	120	478	718	5.2	$298
307B, Office	2	3	32	42	167	251	2	30	120	179	1.3	$74
307C, Closet	4	3	32		335	502	4		239	359	2.6	$144
308, Ceremonial Room	2	3	32		167	251	2		120	179	1.3	$72
AC-2												
Ground Floor:												
169B, Office	1	3	32	21	84	126	1	15	60	90	0.7	$38
AC-3												
Third Floor:												
333C, Computer Room	4	4	32	112	447	670	5	80	319	478	3.5	$200
Sub-totals	1,030			30,126	100,771	149,954	1,099	21,528	71,969	107,096	785	$45,100

Room or Area Description	Proposed Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Material $	Labor $	Total $	Payback Yrs
326C, Office	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	4.8
AHU-7													
Ground Floor:													
154, Kitchen	642	1,284	1,926	14.1	459	917	1,376	10.1	$593	$1,840	$920	$2,760	4.7
AHU-8													
Ground Floor:													
107, Office	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
108, Office	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
113, Security Desk	491	224	224	1.2	351	160	160	0.9	$92	$160	$80	$240	2.6
Second Floor:													
201, Rec./Work	335	1,340	2,010	14.7	239	957	1,435	10.5	$599	$1,920	$960	$2,880	4.8
201A, Office	56	223	335	2.5	40	159	239	1.7	$100	$320	$160	$480	9.6
201B, Office	56	223	335	2.5	40	159	239	1.7	$100	$320	$160	$480	9.6
201C, Office	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
201D, Office	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	4.8
201E, Office	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	4.8
201F, Conference		224	335	2.5		160	239	1.8	$96	$320	$160	$480	5.0
201G, Office	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
201H, Office	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
201I, Office	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
202, Office	84	335	502	3.7	60	239	359	2.6	$149	$480	$240	$720	9.6
203, Office Area	335	1,339	2,009	14.7	239	957	1,435	10.5	$598	$1,920	$960	$2,880	9.6
203A, Conference		111	111	1.3		80	80	0.9	$44	$320	$160	$480	21.8
203B, Office	56	223	335	2.5	40	159	239	1.7	$100	$320	$160	$480	9.6
203C, Office	56	223	335	2.5	40	159	239	1.7	$100	$320	$160	$480	9.6
203D, Office	56	223	335	2.5	40	159	239	1.7	$100	$320	$160	$480	9.6
Third Floor:													
301, Office Area	84	335	503	3.7	60	239	359	2.6	$149	$480	$240	$720	4.8
301A, Office	56	223	335	2.5	40	159	239	1.7	$100	$320	$160	$480	9.6
301B, Office	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
301C, Storage		112	168	1.2		80	120	0.9	$48	$160	$80	$240	5.0
302, Conference Room		167	167	1.9		119	119	1.4	$66	$480	$240	$720	21.7
303, Conference Room		167	167	1.9		119	119	1.4	$66	$480	$240	$720	21.7
305, Corridor & Copy Area	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
305A, Office	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
305B, Office	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
305C, Office	42	167	251	1.9	30	119	179	1.3	$75	$240	$120	$360	9.5
306, Operations	111	447	670	4.9	80	319	479	3.5	$199	$640	$320	$960	9.7
306A, Office	56	223	335	2.5	40	159	239	1.7	$100	$320	$160	$480	9.6
306B, Office	56	223	335	2.5	40	159	239	1.7	$100	$320	$160	$480	9.6
307, Office Area	154	614	921	6.8	110	439	658	4.8	$274	$880	$440	$1,320	4.8
307A, Office	84	335	503	3.7	60	239	359	2.6	$149	$480	$240	$720	4.8
307B, Office	28	111	167	1.2	20	80	119	0.9	$50	$160	$80	$240	9.7
307C, Closet		223	335	2.5		159	239	1.7	$96	$320	$160	$480	10.0
308, Ceremonial Room		111	167	1.2		80	119	0.9	$48	$160	$80	$240	10.0
AC-2													
Ground Floor:													
169B, Office	14	56	84	0.6	10	40	60	0.5	$25	$80	$40	$120	9.4
AC-3													
Third Floor:													
333C, Computer Room	56	224	335	2.5	40	160	239	1.8	$100	$320	$160	$480	4.8
Sub-totals	17,527	56,798	84,490	619	12,525	40,567	60,342	443	$25,500	$82,200	$41,100	$123,400	6.3

Number of Lamps	3,652
Number of Ballasts	2,060

Non-Summer Incrementals

Winter Incremental Demand Cost $/Kw =	$6.60
Off-Peak Incremental Usage Cost $/Kwh =	$0.0370
Intermediate Incremental Usage Cost $/Kwh	$0.0460
On-Peak Incremental Usage Cost $/Kwh =	$0.0530

Summer Incrementals

Winter Incremental Demand Cost $/Kw =	$17.09
Off-Peak Incremental Usage Cost $/Kwh =	$0.0340
Intermediate Incremental Usage Cost $/Kw	$0.0470
On-Peak Incremental Usage Cost $/Kwh =	$0.0620

ECO-11
3' HPS Bollards

Existing. Presently, Marshall Hall utilizes 5, 150 watt incandescent three foot bollard luminaires near the east entrance to the building. The luminaires are located along a portion of the roadway where individuals would depart from vehicles. Presently they are controlled by photocells. The current lamps have a lumen rating of 2,800 and a life expectancy of 750 hours. From the attached sheet, the annual electric demand for these luminaires is 0 kW and usage is 2,970 kWh. The annual cost for the existing lights is $120. All quantities have been developed from the light model and are calculated in the attachment. The table below summarizes the estimates.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	0	1,260	420	315	$83
Summer	0	675	300	0	$37
Totals	0	1,935	720	315	$120

Proposed. Remove the existing luminaires and install new recessed 35 watt HPS bollards. The new 35 watt HPS lamps will provide a lumen output of 2,300. Replacement luminaires will be capable of being housed in the same location. The retrofit is expected to lower electric demand to 0 kW/yr and electric usage to 772 kWh/yr. The annual energy cost for the retrofit is $30. The lower energy cost is due to reducing lamp wattage from 150 watts to 35 watts.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	0	338	98	74	$21
Summer	0	181	81	0	$10
Totals	0	519	179	74	$30

Construction Cost.	The expected construction cost for this project is \$800. (reference attached data sheet).

Material	\$	500
Labor	\$	200
Engineering	\$	100

Savings. The annual cost savings resulting from the implementation of this project will be \$90 (\$120 - \$30).

Non-Summer kW	=	0 kW/yr (0 kW/yr - 0 kW/yr)
Summer kW	=	0 kW/yr (0 kW/yr - 0 kW/yr)
Off-Peak kWh	=	1,416 kWh/yr (1,935 kWh/yr - 519 kWh/yr)
Intermediate kWh	=	541 kWh/yr (720 kWh/yr - 179 kWh/yr)
On-Peak kWh	=	241 kWh/yr (315 kWh/yr - 74 kWh/yr)
Energy Usage	=	8 mmBtu/yr ((1,416 kWh + 541 kWh + 241 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu
Btu/sf	=	31 Btu/sf ((1,416 kWh + 541 kWh + 241 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion. Maintenance savings due to the use of HPS lamps is estimated to be \$110 as calculated below. The expected payback resulting from the implementation of this project is 4.0 years (\$800 ÷ \$200).

<u>Existing</u>

Hours of operation	=	20,000 hrs (4,000 hrs/lum x 5 lum)
Changes per year	=	27 changes (20,000 hrs ÷ 750 hrs)
Cost per year	=	\$190 (27 changes x (\$2.00/lamp + \$5.00 labor))

Proposed

Hours of operation	=	20,000 hrs (4,000 hrs/lum x 5 lum)
Changes per year	=	4 changes (20,000 hrs ÷ 5,000 hrs)
Cost per year	=	$190 (4 changes x ($15.00/lamp + $5.00 labor))
Savings	=	$110 ($190 - $80)

ECO-11
3 foot Bollards

				EXISTING								
				Non-Summer Annual Totals				Summer Annual Totals				
Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
3 foot exterior bollards	5	1	150	1,260	420	315	0	675	300	0	0.0	$120
Sub-totals	5			1,260	420	315	0	675	300	0	0	$120

				PROPOSED								
				Non-Summer Annual Totals				Summer Annual Totals				
Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
3 foot exterior bollards	5	1	35	338	98	74		181	81			$30
Sub-totals	5			338	98	74	0	181	81	0	0	$30

				Construction Cost					
Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Material $	Labor $	Engineering $	Total $	Savings $	Payback Yrs
3 foot exterior bollards	5	1	35	$500	$200	$100	$800	$90	8.9
Sub-totals	5			$500	$200	$100	$800	$90	8.9

Non-Summer Incrementals	
Winter Incremental Demand Cost $/K	$6.60
Off-Peak Incremental Usage Cost $/K	$0.0370
Intermediate Incremental Usage Cost	$0.0460
On-Peak Incremental Usage Cost $/K	$0.0530

Summer Incrementals	
Winter Incremental Demand Cost $/Kw =	$17.09
Off-Peak Incremental Usage Cost $/Kwh	$0.0340
Intermediate Incremental Usage Cost $/K	$0.0470
On-Peak Incremental Usage Cost $/Kwh	$0.0620

NOTE #1: FOR BALLASTED LUMINAIRE A BALLAST FACTOR OF 1.15 IS USED, INCANDESCENT LUMINAIRE USE 1.

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24-Aug-95

ECO-12
Replace 75 watt Mercury Vapor Wall Washers

Existing. Presently, Marshall Hall utilizes approximately 61 wall washers utilizing 75 watt mercury vapor lamps providing 2,800 lumens. These luminaires are primarily located in common and open areas on the first through third floors From the attached sheets, the annual electric demand for these areas is 60 kW and usage is 15,048 kWh. The annual costs for the existing lights are $1,400. All quantities have been developed from the light model and are calculated in the attachment. The table below summarizes the estimates.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	35	798	3,192	4,788	$660
Summer	25	570	2,280	3,420	$770
Totals	60	1,368	5,472	8,208	$1,400

Proposed. Remove the existing luminaire and install new compact fluorescent wall washers. The new wall washers will contain two 18 watt compact fluorescent lamps providing a total of 2,500 lumens (10% reduction). Replacement luminaires will be capable of being housed in the same location with minor alterations to ceiling tiles. The retrofit is expected to lower electric demand to 29 kW/yr and electric usage to 8,165 kWh/yr. The annual energy cost for the retrofit is $700. The reduction in annual energy cost is due to lowering lamp wattage from 75 watts to 36 watts.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	17	383	1,532	2,298	$320
Summer	12	359	1,437	2,156	$420
Totals	29	742	2,969	4,454	$700

Construction Cost.	The expected construction cost for this project is \$6,500. (reference attached data sheet).

Material	\$	4,900
Labor	\$	1,200
Engineering	\$	400

Savings. The annual cost savings resulting from the implementation of this project will be \$700 (\$1,400 - \$700).

Off-Peak kWh	=	626 kWh/yr (1,368 kWh/yr - 742 kWh/yr)
Intermediate kWh	=	2,507 kWh/yr (5,472 kWh/yr - 2,969 kWh/yr)
On-Peak kWh	=	3,748 kWh/yr (8,208 kWh/yr - 4,454 kWh/yr)
Non-Summer kW	=	18 kW/yr (35 kW/yr - 17 kW/yr)
Summer kW	=	13 kW/yr (25 kW/yr - 12 kW/yr)
Energy Usage	=	23 mmBtu/yr ((626 kWh + 2,503 kWh + 3,754 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu
Btu/sf	=	96 Btu/sf ((626 kWh + 2,503 kWh + 3,754 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion. The expected payback resulting from the implementation of this project is 9.3 years (\$6,500 ÷ \$700). There is no additional monetary savings due to reduced maintenance.

ECO-12
Replace 75 watt Mercury Wall Washers

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	EXISTING: Non-Summer Annual Totals Off-Peak Kwh	Non-Summer Inter. Kwh	Non-Summer On-Peak Kwh	Winter kW	Summer Annual Totals Off-Peak Kwh	Summer Inter. Kwh	Summer On-Peak Kwh	Summer kW	Cost $
Lobby & Vestibules	22	1	75	288	1,151	1,727	13	206	822	1,233	9.0	$514
Lobby, Corridors, & Open Areas	27	1	75	353	1,413	2,119	16	252	1,009	1,514	11.1	$632
Open Areas & Corridors	12	1	75	157	628	942	7	112	449	673	4.9	$281
Sub-totals	61			798	3,192	4,788	35	570	2,280	3,420	25	$1,400

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	PROPOSED: Non-Summer Annual Totals Off-Peak Kwh	Non-Summer Inter. Kwh	Non-Summer On-Peak Kwh	Winter kW	Summer Annual Totals Off-Peak Kwh	Summer Inter. Kwh	Summer On-Peak Kwh	Summer kW	Cost $
Lobby & Vestibules	22	1	18	138	552	829	6.0	99	395	592	4.3	$247
Lobby, Corridors, & Open Areas	27	1	18	169	678	1,017	7.4	121	484	727	5.3	$303
Open Areas & Corridors	12	1	18	75	301	452	3.3	54	216	323	2.4	$135
Sub-totals	61			383	1,532	2,298	17	359	1,437	2,156	12	$700

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Construction Cost: Material $	Labor $	Engineering $	Total $	Savings $	Payback Yrs
Lobby & Vestibules	22	1	18	$1,760	$440	$100	$2,300	$267	8.6
Lobby, Corridors, & Open Areas	27	1	18	$2,160	$540	$200	$2,900	$329	8.8
Open Areas & Corridors	12	1	18	$960	$240	$100	$1,300	$146	8.9
Sub-totals	61			$4,900	$1,200	$400	$6,500	$700	9.3

Number of Lamps 61
Number of Ballasts 61

Non-Summer Incrementals		Summer Incrementals	
Winter Incremental Demand Cost $/Kw =	$6.60	Winter Incremental Demand Cost $/Kw =	$17.09
Off-Peak Incremental Usage Cost $/Kwh =	$0.0370	Off-Peak Incremental Usage Cost $/Kwh	$0.0340
Intermediate Incremental Usage Cost $/Kw	$0.0460	Intermediate Incremental Usage Cost $/K	$0.0470
On-Peak Incremental Usage Cost $/Kwh =	$0.0530	On-Peak Incremental Usage Cost $/Kwh	$0.0620

ECO-13
Personnel Motion Sensors

Existing. Marshall Hall contains approximately 130 spaces which were observed illuminated for many hours, even when unoccupied. The attached sheet displays the areas which have been identified. From the attached calculations, the annual demand and usage for these spaces is 620 kW and 156,398 kWh with an annual electric cost of $14,800.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	362	8,367	33,146	49,728	$6,859
Summer	258	5,980	23,665	35,512	$7,927
Totals	620	14,347	56,811	85,240	$14,800

Proposed. Remove the existing standard light switches and replace them with motion sensor switches for the above-referenced spaces (refer to the sheets). This will allow the lights to operate only when the space is occupied. Demand levels are not expected to be reduced; however usage hours are expected to be reduced to 70% of current levels. This reduction is in accordance with DOE Advanced Lighting Guidelines, 1993. Typically office spaces can expect between 25 and 50% reduction in usage. Switch replacement will reduce the annual electric cost to approximately $12,400. Electrical demand and usage will be 620 kW and 109,478 kWh.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	362	5,857	23,202	34,810	$5,518
Summer	258	4,186	16,565	24,858	$6,871
Totals	620	10,043	39,767	59,668	$12,400

Construction Cost. The total construction cost to install the described modifications is $15,000.

Material	$ 10,200
Labor	$ 3,900
Engineering	$ 900

Savings. The annual cost savings associated with this ECO is $2,400 ($14,800 - $12,400).

Off-Peak kWh = 4,394 kWh (14,437 kWh - 10,043 kWh)

Intermediate kWh = 17,044 kWh (56,811 kWh - 39,767 kWh)

On-Peak kWh = 25,572 kWh (85,240 kWh - 59,668 kWh)

Summer kW = 0 kW (362 kW - 362 kW)

Non-Summer kW = 0 kW (258 kW - 258 kW)

Energy Usage = 160 mmBtu ((4,394 kWh + 17,044 kWh + 25,572 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu)

Energy Usage = 659 Btu/sf ((4,394 kWh + 17,044 kWh + 25,572 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion. The simple payback for this ECO is 6.3 years ($15,000/$2,400). There is no addition monetary savings due to reduce maintenance.

Motion Sensors

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Existing Non-Summer Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Existing Summer Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Proposed Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Material $	Labor $	Total $	Payback Yrs
AHU-2																									
170A, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
173A, Office	1	3	40	21	84	126	1	15	60	90	0.7	$38	15	59	88	0.9	11	42	63	0.7	$32	$80	$30	$110	18.1
174A, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
174C, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
174D, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
177A, Office	2	2	40	28	112	167	1	20	80	120	0.9	$50	20	78	117	1.2	14	56	84	0.9	$42	$80	$30	$110	13.6
177B, Office	2	2	40	28	112	167	1	20	80	120	0.9	$50	20	78	117	1.2	14	56	84	0.9	$42	$80	$30	$110	13.6
177C, Office	4	2	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
177D, Office	2	2	40	28	112	167	1	20	80	120	0.9	$50	20	78	117	1.2	14	56	84	0.9	$42	$80	$30	$110	13.6
183A, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
183G, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
183I, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
183J, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
183K, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
AHU-3																									
Ground Floor:																									
188A, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
Second Floor:																									
245B, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	20	78	117	1.2	14	56	84	0.9	$42	$80	$30	$110	13.6
245C, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
245D, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
246, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
Third Floor:																									
333A, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
333B, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
AHU-5																									
Ground Floor:																									
119, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
120, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
121, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
124, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
126, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
127, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
128, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
129, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
130, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
131, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
132, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
133, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
134, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
135, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
136, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
137, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
138, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
139, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
140, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
141, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
142, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
144, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
144A, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
146, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	78	313	469	4.9	56	223	335	3.5	$167	$80	$30	$110	3.4
147, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
148, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
149, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
150, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
151, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
Second Floor:																									
209A, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209B, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209C, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209D, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209E, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209F, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209H, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209I, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209J, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209L, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209M, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209N, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
209O, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209P, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
209Q, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
210, Office	8	3	40	167	670	1,005	7	120	478	718	5.2	$298	117	469	704	7.3	84	335	503	5.2	$250	$80	$30	$110	2.3
210B, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	78	313	469	4.9	56	223	335	3.5	$167	$80	$30	$110	3.4
210C, Office	8	3	40	167	670	1,005	7	120	478	718	5.2	$298	117	469	704	7.3	84	335	503	5.2	$250	$80	$30	$110	2.3
210D, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	78	313	469	4.9	56	223	335	3.5	$167	$80	$30	$110	3.4
210E, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	78	313	469	4.9	56	223	335	3.5	$167	$80	$30	$110	3.4
210F, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
210G, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	20	78	117	1.2	14	56	84	0.9	$42	$80	$30	$110	13.6
210H, Office	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	117	469	704	7.3	84	335	503	5.2	$250	$80	$30	$110	2.3
210I, Office	1	2	40	14	56	84	1	10	40	60	0.4	$24	10	39	59	0.6	7	28	42	0.4	$20	$80	$30	$110	27.2
211A, Office	6	3	40	126	502	753	6	90	359	538	3.9	$224	88	351	527	5.5	63	251	377	3.9	$188	$80	$30	$110	3.0
211B, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
211C, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
211D, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
212C, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
212D, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
212E, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
212F, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
212G, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
212H, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	78	313	469	4.9	56	223	335	3.5	$167	$80	$30	$110	3.4
212I, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	78	313	469	4.9	56	223	335	3.5	$167	$80	$30	$110	3.4
Third Floor:																									
309A, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
309B, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
309C, Office	5	4	40	140	558	837	6	100	399	598	4.4	$250	98	391	586	6.1	70	279	419	4.4	$210	$80	$30	$110	2.7
314D, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Existing Non-Summer Annual Totals				Existing Summer Annual Totals					Proposed Annual Totals												
				Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $	Material $	Labor $	Total $	Payback Yrs
314L, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	78	313	469	4.9	56	223	335	3.5	$167	$80	$30	$110	3.4
314M, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
314N, Office	3	4	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
314O, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	78	313	469	4.9	56	223	335	3.5	$167	$80	$30	$110	3.4
314R, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	20	78	117	1.2	14	56	84	0.9	$42	$80	$30	$110	13.6
314S, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	20	78	117	1.2	14	56	84	0.9	$42	$80	$30	$110	13.6
AHU-6																							$30	$30	ERR
Third Floor:																							$30	$30	ERR
316B, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
319E, Office	2	4	40	56	223	335	2	40	159	239	1.7	$99	39	156	235	2.4	28	111	167	1.7	$83	$80	$30	$110	6.8
326B, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	20	78	117	1.2	14	56	84	0.9	$42	$80	$30	$110	13.6
326C, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	20	78	117	1.2	14	56	84	0.9	$42	$80	$30	$110	13.6
AHU-7																									
Ground Floor:																									
154A, Office	2	2	40	56	112	167	1	40	80	120	0.9	$52	39	78	117	1.2	28	56	84	0.9	$43	$80	$30	$110	12.8
154B, Office	2	2	40	56	112	167	1	40	80	120	0.9	$52	39	78	117	1.2	28	56	84	0.9	$43	$80	$30	$110	12.8
AHU-8																									
Ground Floor:																									
107, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
108, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
Second Floor:																									
201A, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
201B, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
201C, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
201D, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	20	78	117	1.2	14	56	84	0.9	$42	$80	$30	$110	13.6
201E, Office	1	4	40	28	112	167	1	20	80	120	0.9	$50	20	78	117	1.2	14	56	84	0.9	$42	$80	$30	$110	13.6
201G, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
201H, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
201I, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
202, Office	6	3	40	126	502	753	6	90	359	538	3.9	$224	88	351	527	5.5	63	251	377	3.9	$188	$80	$30	$110	3.0
203B, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
203C, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
203D, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
Third Floor:																									
301A, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
301B, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	78	313	469	4.9	56	223	335	3.5	$167	$80	$30	$110	3.4
305A, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
305B, Office	4	4	40	112	447	670	5	80	319	478	3.5	$200	78	313	469	4.9	56	223	335	3.5	$167	$80	$30	$110	3.4
305C, Office	3	3	40	63	251	377	3	45	179	269	2.0	$113	44	176	264	2.8	32	125	188	2.0	$95	$80	$30	$110	6.1
306A, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
306B, Office	4	3	40	84	335	502	4	60	239	359	2.6	$150	59	235	351	3.7	42	167	251	2.6	$125	$80	$30	$110	4.5
307A, Office	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	117	469	704	7.3	84	335	503	5.2	$250	$80	$30	$110	2.3
307A, Office	1	2	40	14	56	84	1	10	40	60	0.4	$24	10	39	59	0.6	7	28	42	0.4	$20	$80	$30	$110	27.2
307B, Office	2	3	40	42	167	251	2	30	120	179	1.3	$74	29	117	176	1.8	21	84	125	1.3	$62	$80	$30	$110	9.1
AC-2																									
Ground Floor:																									
169B, Office	1	3	40	21	84	126	1	15	60	90	0.7	$38	15	59	88	0.9	11	42	63	0.7	$32	$80	$30	$110	18.1
AC-3																									
313B, Office	6	4	40	167	670	1,005	7	120	478	718	5.2	$298	117	469	704	7.3	84	335	503	5.2	$250	$80	$30	$110	2.3
Sub-totals	346			8,367	33,146	49,728	362	5,980	23,665	35,512	258	$14,800	5,857	23,202	34,810	362	3,770	14,919	22,388	258	$12,400	$10,200	$3,900	$14,000	5.8

Number of Lamps	1,188
Number of Ballasts	676

Non-Summer Incrementals		Summer Incrementals	
Winter Incremental Demand Cost $/Kw -	$6.60	Winter Incremental Demand Cost $/Kw -	$17.09
Off-Peak Incremental Usage Cost $/Kwh	$0.0370	Off-Peak Incremental Usage Cost $/Kwh -	$0.0340
Intermediate Incremental Usage Cost $/K	$0.0460	Intermediate Incremental Usage Cost $/Kw	$0.0470
On-Peak Incremental Usage Cost $/Kwh	$0.0530	On-Peak Incremental Usage Cost $/Kwh -	$0.0620

$5.83 2,400

NOTE #1: FOR BALLASTED LUMINAIRE A BALLAST FACTOR OF 1.15 IS USED, INCANDESCENT LUMINAIRE USE 1.

ECO-14
Exit Signs to LED

Existing. Presently Marshall Hall contains approximately 105 exit signs of various mounting and directional types. The existing signs utilize two eight watt (8) fluorescent lamps. The total watts for the existing exit signs are 1,932 watts. The exit signs operate 24 hours per day and contribute approximately 95% of their connected load to the demand. Total annual electric demand is 19 kW while annual electric usage is 16,877 kWh. Annual energy cost for these fixtures is $900. All quantities have been developed from the light model and are calculated in the attachment.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	11	5,157	2,344	2,344	$500
Summer	8	3,684	1,674	1,674	$440
Totals	19	8,841	4,018	4,018	$900

Proposed. Remove and replace all existing exit signs with a new LED exit signs. The existing exit signs can not be retrofitted because they are too thin. New LED exit signs will consume 2 watts of electricity per luminaire and have a life expectancy over 20 years.. The annual energy cost for the new luminaires will be $100. The expected usage and demand quantifies are summarized below and calculated in the attachment.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	2	561	258	258	$60
Summer	1	420	182	182	$50
Totals	3	981	440	440	$100

Construction Cost.	The expected construction cost for this project is $13,000.

Material	$ 8,400	(105 lum x $80/lum)
Labor	$ 4,200	(105 lum x $40/lum)
Engineering	$ 400	

Savings. The annual cost savings resulting from the implementation of this project will be $800 ($900 - $100).

Off-Peak kWh = 7,860 kWh/yr (8,841 kWh/yr - 981 kWh/yr)

Intermediate kWh = 3,578 kWh/yr (4,018 kWh/yr - 440 kWh/yr)

On-Peak kWh = 3,578 kWh/yr (4,018 kWh/yr - 440 kWh/yr)

Non-Summer kW = 9 kW/yr (11 kW/yr - 2 kW/yr)

Summer kW = 7 kW/yr (8 kW/yr - 1 kW/yr)

Energy Usage = 51 mmBtu/yr ((7,860 kWh + 3,578 kWh + 3,578 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu

Btu/sf = 211 Btu/sf ((7,860 kWh + 3,578 kWh + 3,578 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion. The expected simple payback resulting from the implementation of this project is 16.3 years ($13,000÷$800). However, if maintenance savings for lamp replacement are included, there is an additional $1,050 per year savings (.5 hr/lum. x $20/mh. x 105 lum. = $1,050). The payback period decreases to 7.2 years ($13,000÷$1,800).

6.3 ECOs Evaluated but Not Recommended

In addition to the recommended ECOs listed in Section 6.2 of this report, potential energy conservation opportunities were investigated, but are not recommended for implementation due to their long payback periods. These projects may still be attractive to Ft. McNair due to non-economical factors such as increased comfort or a reduction in maintenance requirements. Other projects, while not feasible at this time, should be considered when replacement of the existing equipment is required.

ECO #	*ECO Description*
A	150 HPS Loading Dock Luminaires
B	2' and 3' T-8 Lamp Retrofit
C	3' MH Bollards
D	Exterior Lighting
E	Shutdown Chillers During Winter & Summer Unoccupied Periods
F	Security Room
G	Variable Frequency Drive Controllers
H	Peak Shaving With Diesel Generators
I	Chilled Water Storage
J	Oxygen Trim Controls on Boilers
K	PEPCO's Curtailment Program
L	Electric Rate

ECO-A
150 HPS Loading Dock Luminaires

Existing. Presently, Marshall Hall utilizes approximately 28, 175 watt recessed mercury vapor luminaires in the first floor loading dock. The current lamps have an initial lumen rating of 14,000 and a maintained level of 10,000. From the attached sheet, the annual electric demand for this area is 65 kW and usage is 49,228 kWh. The annual cost for the existing lights is $2,800. All quantities have been developed from the light model and are calculated in the attachment. The table below summarizes the estimates.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	38	15,042	6,837	6,837	$1,480
Summer	27	10,744	4,884	4,884	$1,360
Totals	65	25,786	11,721	11,721	$2,800

Proposed. Remove the existing luminaires and install new recessed 150 watt HPS luminaires. The new 150 watt HPS lamps will provide an initial lumen output of 16,000 and maintained level of 14,400 lumens (40% increase). Replacement luminaires will be capable of being housed in the same location with minor alterations. The retrofit is expected to lower electric demand to 55 kW/yr and electric usage to 42,194 kWh/yr. The annual energy cost for the retrofit is $2,400. The lower energy cost is due to the use of a lowering lamp wattage from 175 watts to 150 watts.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	32	12,893	5,860	5,860	$1,270
Summer	23	9,209	4,186	4,186	$1,160
Totals	55	22,102	10,046	10,046	$2,400

Construction Cost.	The expected construction cost for this project is $6,500. (Reference attached data sheet).

Material	$ 4,200
Labor	$ 1,700
Engineering	$ 600

Savings. The annual cost savings resulting from the implementation of this project will be $400 ($2,800 - $2,400).

Off-Peak kWh	=	3,684 kWh/yr (25,786 kWh/yr - 22,102 kWh/yr)
Intermediate kWh	=	1,675 kWh/yr (11,721 kWh/yr - 10,046 kWh/yr)
On-Peak kWh	=	1,675 kWh/yr (11,721 kWh/yr - 10,046 kWh/yr)
Non-Summer kW	=	6 kW/yr (38 kW/yr - 32 kW/yr)
Summer kW	=	4 kW/yr (27 kW/yr - 23 kW/yr)
Energy Usage	=	24 mmBtu/yr ((3,684 kWh + 1,675 kWh + 1,675 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu
Btu/sf	=	99 Btu/sf ((3,684 kWh + 1,675 kWh + 1,675 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion. The expected payback resulting from the implementation of this project is 16.3 years ($6,500 ÷ $400). There is no additional monetary savings due to reduced maintenance.

ECO-A

150 Watt HPS Dock Lights

				EXISTING								
				Non-Summer Annual Totals				Summer Annual Totals				
Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
176A, Loading Area	28	1	175	15,042	6,837	6,837	38	10,744	4,884	4,884	27	$2,837
Sub-totals	28			15,042	6,837	6,837	38	10,744	4,884	4,884	27	$2,800

				PROPOSED								
				Non-Summer Annual Totals				Annual Totals				
Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
176A, Loading Area	28	1	150	12,893	5,860	5,860	32	9,209	4,186	4,186	23	$2,431
Sub-totals	28			12,893	5,860	5,860	32	9,209	4,186	4,186	23	$2,400

				Construction Cost					
Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Material $	Labor $	Engineering $	Total $	Savings $	Payback Yrs
176A, Loading Area	28	1	150	$4,200	$1,700	$600	$6,500	$400	16.0
Sub-totals	28			$4,200	$1,700	$600	$6,500	$400	16.3

Number of Lamps 28
Number of Ballasts 28

Non-Summer Incrementals		Summer Incrementals	
Winter Incremental Demand Cost \$/Kw =	\$6.60	Winter Incremental Demand Cost \$/Kw =	\$17.09
Off-Peak Incremental Usage Cost \$/Kwh =	\$0.0370	Off-Peak Incremental Usage Cost \$/Kwh	\$0.0340
Intermediate Incremental Usage Cost \$/Kw	\$0.0460	Intermediate Incremental Usage Cost \$/K	\$0.0470
On-Peak Incremental Usage Cost \$/Kwh =	\$0.0530	On-Peak Incremental Usage Cost \$/Kwh	\$0.0620

NOTE #1: FOR BALLASTED LUMINAIRE A BALLAST FACTOR OF 1.15 IS USED, INCANDESCENT LUMINAIRE USE 1.

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ECO-B
2' and 3' T-8 Lamp Retrofit

Existing. Presently, Marshall Hall utilizes approximately 414 fluorescent luminaires containing 414 lamps and 414 ballasts in the first floor Multi-Purpose rooms and third floor Ceremonial room. The luminaires range primarily single lamp and basically utilize 30 and 20 watt, cool white lamps with standard energy efficient magnetic ballast. From the attached sheets, the annual electric demand for these areas is 159 kW and usage is 36,240 kWh. The annual costs for the existing lights are $3,600. All quantities have been developed from the light model and are calculated in the attachment. The table below summarizes the estimates.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	93	0	8,456	12,684	$1,675
Summer	66	0	6,039	9,061	$1,974
Totals	159	0	14,495	21,745	$3,600

Proposed. Remove the existing lamps and ballasts and install new Sylvania Octron (or equivalent) T-8 lighting system with electronic ballasts. The average electrical use per lamp for three foot replacements will be approximately 24 watts while two foot replacements will be 17 watts. The three foot luminaires will be tandem ballasted (one ballast two luminaires) while two foot luminaires contain one ballast. Octron lamps are thinner and can be installed into the luminaire using existing pin connectors. The retrofit is expected to lower electric demand to 111 kW/yr and electric usage to 24,271 kWh/yr. The annual energy cost for the retrofit is $2,500.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	65	0	5,901	8,851	$1,170
Summer	46	0	3,807	5,712	$1,320
Totals	111	0	9,708	14,563	$2,500

Construction Cost. The expected construction cost for this project is $19,000. (Reference attached data sheet).

Material	$ 9,300
Labor	$ 8,300
Engineering	$ 1,400

Savings. The annual cost savings resulting from the implementation of this project will be $1,100 ($3,600 - $2,500).

Off-Peak kWh = 0 kWh/yr (0 kWh/yr - 0 kWh/yr)

Intermediate kWh = 4,787 kWh/yr (14,495 kWh/yr - 9,708 kWh/yr)

On-Peak kWh = 7,182 kWh/yr (21,745 kWh/yr - 14,563 kWh/yr)

Non-Summer kW = 28 kW/yr (93 kW/yr - 65 kW/yr)

Summer kW = 20 kW/yr (66 kW/yr - 46 kW/yr)

Energy Usage = 41 mmBtu/yr ((0 kWh + 4,787 kWh + 7,182 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu

Btu/sf = 168 Btu/sf ((0 kWh + 4,787 kWh + 7,182 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion. The expected payback resulting from the implementation of this project is 17.3 years ($19,000 ÷ $1,100). The retrofit is estimated to provide a reduction in cooling costs and no increase in heating costs, This analysis is shown below.

Cooling Savings, 5 Summer Months

Description	Light Savings	Equiv Cool @ 5 cop	Cost Savings
Off-Peak, kWh	0	0	$0
Intermediate, kWh	2,232	446	$21
On-Peak, kWh	3,349	670	$42
Demand, kW	20	4	$68
Total			$100

The retrofit will decrease HVAC cost by $100. Thus the simple payback for this project will increase to 14.6 years (19,000 ÷ (1,200 + $100)). There is no additional monetary savings due to reduced maintenance.

EC[illegible]-B
2' and 3' T-8 Retrofit

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	EXISTING: Non-Summer Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Summer Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
155A, Multi-Purpose Room	96	1	30		2,009	3,014	22		1,435	2,153	15.7	$867
155B, Multi-Purpose Room	192	1	30		4,019	6,028	44		2,870	4,306	31.5	$1,735
155A, Multi-Purpose Room	96	1	30		2,009	3,014	22		1,435	2,153	15.7	$867
308, Ceremonial Room	30	1	20		419	628	5		299	449	3.3	$181
Sub-totals	414			0	8,456	12,684	93	0	6,039	9,061	66	$3,600

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	PROPOSED: Non-Summer Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Summer Annual Totals Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
155A, Multi-Purpose Room	96	1	24		1,398	2,097	15.3		998	1,498	10.9	$603
155B, Multi-Purpose Room	192	1	24		2,796	4,193	30.6		1,997	2,995	21.9	$1,207
155A, Multi-Purpose Room	96	1	24		1,398	2,097	15.3		998	1,498	10.9	$603
308, Ceremonial Room	30	1	17		310	464	3.4		221	332	2.4	$134
Sub-totals	414			0	5,901	8,851	65		3,807	5,712	46	$2,500

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Construction Cost: Material $	Labor $	Engineering $	Total $	Savings $	Payback Yrs
155A, Multi-Purpose Room	96	1	24	$2,160	$1,920	$300	$4,380	$264	16.6
155B, Multi-Purpose Room	192	1	24	$4,320	$3,840	$700	$8,860	$528	16.8
155A, Multi-Purpose Room	96	1	24	$2,160	$1,920	$300	$4,380	$264	16.6
308, Ceremonial Room	30	1	17	$675	$600	$100	$1,375	$47	29.1
Sub-totals	414			$9,300	$8,300	$1,400	$19,000	$1,100	17.3

Number of Lamps 414
Number of Ballasts 414

Non-Summer Incrementals		Summer Incrementals	
Winter Incremental Demand Cost $/Kw =	$6.60	Winter Incremental Demand Cost $/Kw =	$17.09
Off-Peak Incremental Usage Cost $/Kwh =	$0.0370	Off-Peak Incremental Usage Cost $/Kwh	$0.0340
Intermediate Incremental Usage Cost $/Kw	$0.0460	Intermediate Incremental Usage Cost $/K	$0.0470
On-Peak Incremental Usage Cost $/Kwh =	$0.0530	On-Peak Incremental Usage Cost $/Kwh	$0.0620

ECO-C
3' MH Bollards

Existing. Presently, Marshall Hall utilizes 5, 150 watt incandescent three foot bollard luminaires near the east entrance to the building. The luminaires are located along a portion of the roadway where individuals would depart from vehicles. Presently they are controlled by photocells. The current lamps have a lumen rating of 2,800 and a life expectancy of 750 hours. From the attached sheet, the annual electric demand for these luminaires is 0 kW and usage is 2,970 kWh. The annual cost for the existing lights is $120. All quantities have been developed from the light model and are calculated in the attachment. The Table below summarizes the estimates.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	0	1,260	420	315	$83
Summer	0	675	300	0	$37
Totals	0	1,935	720	315	$120

Proposed. Remove the existing luminaires and install new recessed 50 watt metal halide bollards. The new 50 watt lamps will provide a lumen output of 3,000. Replacement luminaires will be capable of being housed in the same location. The retrofit is expected to lower electric demand to 0 kW/yr and electric usage to 1,102 kWh/yr. The annual energy cost for the retrofit is $40. The lower energy cost is due to reducing lamp wattage from 150 watts to 50 watts.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	0	483	140	105	$30
Summer	0	259	115	0	$14
Totals	0	742	255	105	$40

Construction Cost.	The expected construction cost for implementation of this project will be $800. This cost is summarized below and shown in detail on the following page.

Material	$	500
Labor	$	200
Engineering	$	100

Savings.	The annual cost savings resulting from the implementation of this project will be $80 ($120 - $40).

Off-Peak kWh	=	1,193 kWh/yr (1,935 kWh/yr - 742 kWh/yr)
Intermediate kWh	=	465 kWh/yr (720 kWh/yr - 255 kWh/yr)
On-Peak kWh	=	210 kWh/yr (315 kWh/yr - 105 kWh/yr)
Non-Summer kW	=	0 kW/yr (0 kW/yr - 0 kW/yr)
Summer kW	=	0 kW/yr (0 kW/yr - 0 kW/yr)
Energy Usage	=	6 mmBtu/yr ((1,193 kWh + 462 kWh + 210 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu
Btu/sf	=	26 Btu/sf ((1,193 kWh + 465 kWh + 210 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion.	The expected payback resulting from the implementation of this project is 10.0 years ($800 ÷ $80). This ECO is not recommended because the HPS version has a better payback period. This ECO will have the same additional maintenance savings as ECO#11. Payback period will be 4.2 years ($800 ÷ $190).

ECO-C
3 foot M.H. Bollards

				EXISTING								
				Non-Summer Annual Totals				Summer Annual Totals				
Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
3 foot exterior bollards	5	1	150	1,260	420	315	0	675	300	0	0.0	$120
Sub-totals	5			1,260	420	315	0	675	300	0	0	$120

				PROPOSED								
				Non-Summer Annual Totals				Summer Annual Totals				
Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
3 foot exterior bollards	5	1	50	483	140	105		259	115			$44
Sub-totals	5			483	140	105	0	259	115	0	0	$40

				Construction Cost					
Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Material $	Labor $	Engineering $	Total $	Savings $	Payback Yrs
3 foot exterior bollards	5	1	50	$500	$200	$100	$800	$80	10.6
Sub-totals	5			$500	$200	$100	$800	$80	10.0

Non-Summer Incrementals		Summer Incrementals	
Winter Incremental Demand Cost $/Kw =	$6.60	Winter Incremental Demand Cost $/Kw =	$17.09
Off-Peak Incremental Usage Cost $/Kwh =	$0.0370	Off-Peak Incremental Usage Cost $/Kwh	$0.0340
Intermediate Incremental Usage Cost $/Kw	$0.0460	Intermediate Incremental Usage Cost $/K	$0.0470
On-Peak Incremental Usage Cost $/Kwh =	$0.0530	On-Peak Incremental Usage Cost $/Kwh	$0.0620

NOTE #1: FOR BALLASTED LUMINAIRE A BALLAST FACTOR OF 1.15 IS USED, INCANDESCENT LUMINAIRE USE 1.

ECO-D
Exterior Lighting

Existing. Presently, Marshall Hall utilizes a mixture of metal halide and mercury vapor luminaires for exterior illumination. The following table lists the types of luminaires and the areas which they serve:

Type	#	Area Served	Lamps	Wattage
18' Pole, MH	32	Parking	1	250
10' Pole, MH	6	Walkway	1	100
Steps, MV	5	Entrance	1	150
Security, MH	3	Area	2	250
Security, MH	2	Area	1	250

Typically the luminaires are operated at night only and are controlled by either time clocks or photocells. From the attached sheet, the annual electric demand for these luminaires is 0 kW and usage is 44,946 kWh. The annual cost for the existing lights is $1,800. All quantities have been developed from the light model and are calculated in the attachment. The table below summarizes the estimates.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	0	19,068	6,356	4,767	$1,250
Summer	0	10,215	4,540	0	$560
Totals	0	29,283	10,896	4,767	$1,800

Proposed. Remove the existing luminaires and install new high pressure sodium lamped luminaires. The new luminaires will match existing and be provided with a lamp of equivalent lumen output. Replacement luminaires will be capable of being housed in the same location. The retrofit is expected to lower electric demand to

0 kW/yr and electric usage to 34,729 kWh/yr. The annual energy cost for the retrofit is $1,400. Lower energy cost is due to using lower lamp wattage as shown below.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	0	14,734	4,911	3,683	$966
Summer	0	7,893	3,508	0	$433
Totals	0	22,627	8,419	3,683	$1,400

Construction Cost. The expected construction cost for this project is $16,000. (Reference attached data sheet).

Material	$ 13,100
Labor	$ 1,500
Engineering	$ 1,400

Savings. The annual cost savings resulting from the implementation of this project will be $400 ($1,800 - $1,400).

Off-Peak kWh = 6,656 kWh/yr (29,283 kWh/yr - 22,627 kWh/yr)

Intermediate kWh = 2,477 kWh/yr (10,896 kWh/yr - 8,419 kWh/yr)

Non-Summer kW = 0 kW/yr (0 kW/yr - 0 kW/yr)

Summer kW = 0 kW/yr (0 kW/yr - 0 kW/yr)

On-Peak kWh = 1,084 kWh/yr (4,767 kWh/yr - 3,683 kWh/yr)

Energy Usage = 35 mmBtu/yr ((6,656 kWh + 2,477 kWh + 1,084 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu

Btu/sf	=	143 Btu/sf ((6,656 kWh + 2,477 kWh + 1,084 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf)

Discussion. The expected payback resulting from the implementation of this project is 40 years ($16,000 ÷ $400). There is no additional monetary savings due to reduced maintenance.

ECO-D
Exterior Lighting

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	EXISTING: Non-Summer Annual Totals: Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Summer Annual Totals: Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
18' Pole Parking Lot, MH	32	1	250	13,440	4,480	3,360	0	7,200	3,200	0	0.0	$1,277
10' Pole Walkway, MH	6	1	100	1,008	336	252	0	540	240	0	0.0	$96
Step Luminaires, MV	5	1	150	1,260	420	315	0	675	300	0	0.0	$120
Security Luminaires	3	2	250	2,520	840	630	0	1,350	600	0	0.0	$239
Security Luminaires	2	1	250	840	280	210	0	450	200	0	0.0	$80
Sub-totals	48			19,068	6,356	4,767	0	10,215	4,540	0	0	$1,810

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	PROPOSED: Non-Summer Annual Totals: Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Winter kW	Summer Annual Totals: Off-Peak Kwh	Inter. Kwh	On-Peak Kwh	Summer kW	Cost $
18' Pole Parking Lot, MH	32	1	200	10,752	3,584	2,688		5,760	2,560			$1,021
10' Pole Walkway, MH	6	1	70	706	235	176		378	168			$67
Step Luminaires, MV	5	1	70	588	196	147		315	140			$56
Security Luminaires	3	2	200	2,016	672	504		1,080	480			$191
Security Luminaires	2	1	200	672	224	168		360	160			$64
Sub-totals	48			14,734	4,911	3,683	0	7,893	3,508	0	0	$1,400

Room or Area Description	No. Of Lum.	Lamps Per Lum	Watts Per Lamp	Construction Cost: Material $	Labor $	Engineering $	Total $	Savings $	Payback Yrs
18' Pole Parking Lot, MH	32	1	200	$9,600	$960	$1,100	$11,660	$255	45.7
10' Pole Walkway, MH	6	1	70	$1,800	$180	$200	$2,180	$29	75.9
Step Luminaires, MV	5	1	70	$500	$150	$0	$650	$64	10.2
Security Luminaires	3	2	200	$900	$180	$100	$1,180	$48	24.6
Security Luminaires	2	1	200	$300	$60	$0	$360	$16	22.6
Sub-totals	48			$13,100	$1,500	$1,400	$16,000	$400	39.0

Non-Summer Incrementals
Winter Incremental Demand Cost $/Kw = $6.60
Off-Peak Incremental Usage Cost $/Kwh = $0.0370
Intermediate Incremental Usage Cost $/Kw $0.0460

Summer Incrementals
Winter Incremental Demand Cost $/Kw = $17.09
Off-Peak Incremental Usage Cost $/Kwh $0.0340
Intermediate Incremental Usage Cost $/K $0.0470

ECO-E
Shutdown Chillers During Winter & Summer Unoccupied Periods

Existing. During the months of December through March, it is necessary to operate the central chilled water system to keep selected areas of the building cool. In the intermediate and summer months, these chiller also operate during unoccupied time periods to cool these same areas. Typically these areas are computer rooms and areas using fan coil units. The total cost to operate the central chilled water system during the entire year as calculated in the electric model is $75,400.

Off-Peak kWh = 595,131 kWh

Intermediate kWh = 247,768 kWh

On-Peak kWh = 290,014 kWh

Summer kW = 1,226 kW

Non-Summer kW = 754 kW

Refer to attached Existing Energy Usage Table for a more detailed breakdown of operating costs.

Proposed. Shut down the central chilled water system during the winter months by installing individual split system DX units for the computer room and fan coils. These new systems will provide cooling to their respective areas year round. Installation of these units will enable the central chilled water system to shut down from December through March. In addition, during the months of April through November, the central chilled water system will be shut down in the unoccupied time periods. Also the outdoor air dampers on the air handlers will need to be modulated closed to eliminate the outdoor air cooling load. The Energy Monitoring and Control System (EMCS) will be modified so as to shut down the chillers and close the outdoor air dampers in the summer unoccupied periods. The expected annual cost to operate the central chilled water system and the new split systems is $51,900.

Off-Peak kWh	=	162,288 kWh
Intermediate kWh	=	150,429 kWh
On-Peak kWh	=	235,528 kWh
Summer kW	=	1,259 kW
Non-Summer kW	=	536 kW

Refer to attached Proposed Energy Usage Table for a more detailed breakdown of operating costs.

Construction Cost

The expected construction cost for this project is $90,000 (Reference attached cost estimate).

Material	$56,000
Labor	$24,000
Engineering	$10,000

Savings.

The annual cost savings resulting from implementation of this project will be $23,500 ($75,400 - $51,900).

Off-Peak kWh	=	432,551 kWh (595,131 kWh - 162,580 kWh)
Intermediate kWh	=	97,339 kWh (247,768 kWh - 150,429 kWh)
On-Peak kWh	=	54,486 kWh (290,014 kWh - 235,528 kWh)
Summer kW	=	-33 kW (1,226 kW - 1,259 kW)
Non-Summer kW	=	218 kW (754 kW - 536 kW)

Energy Usage	=	1,994 mmBtu ((432,551 kWh + 97,339 kWh + 54,486 kWh) x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
Btu/sf	=	8,193 Btu/sf ((432,551 kWh + 97,339 kWh + 54,486 kWh) x 3,413 Btu/kWh ÷ 234,450 sf)

Discussion. The expected payback resulting from the implementation of this project is 3.8 years ($90,000 ÷ $23,500). There is no additional monetary savings due to reduced maintenance. This ECO is recommended under a lower construction cost version, ECO #4A.

ECO-E
EXISTING ENERGY USAGE TABLE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
CHILLER CH-2	476	955	149,057	52,224	76,563	272,294	123,193	135,406
CHW PUMP P-3	59	42	22,344	8,624	8,624	15,960	6,160	6,160
CW PUMP P-5	79	56	29,925	11,550	11,550	21,375	8,250	8,250
CLG TOWER	93	156	6,265	3,486	5,030	50,049	24,900	29,050
TOWER PAN HTRS	22	0	12,264	3,360	3,360	0	0	0
FAN COIL UNITS (5)	15	10	5,407	2,087	2,087	3,863	1,491	1,491
A/C UNITS (2)	10	7	3,691	1,425	1,425	2,637	1,018	1,018
TOTALS	754	1,226	228,953	82,756	108,639	366,178	165,012	181,375

Electric Cost = $75,400

Non- Summer:			
KW	$4,975	754	kw/yr * $6.60/kw
Off-peak KWH	$8,471	228,953	kwh/yr * $0.037/kwh
Intermediate KWH	$3,807	82,756	kwh/yr * $0.046/kwh
On- peak KWH	$5,758	108,639	kwh/yr * $0.053/kwh
Summer:			
KW	$20,952	1,226	kw/yr * $17.09/kw
Off-peak KWH	$12,450	366,178	kwh/yr * $0.034/kwh
Intermediate KWH	$7,756	165,012	kwh/yr * $0.047/kwh
On- peak KWH	$11,245	181,375	kwh/yr * $0.062/kwh
Totals	$75,414		

ECO-E
PROPOSED ENERGY USAGE TABLE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
CHILLER CH-2	264	842	20,628	20,628	30,942	51,570	64,940	114,600
CHW PUMP P-3	16	49	1,210	1,210	1,814	3,024	3,360	6,160
CW PUMP P-5	21	66	1,620	1,620	2,430	4,050	4,500	8,250
CLG TOWER	57	183	3,735	2,490	2,490	12,450	16,600	29,050
TOWER PAN HTR	11	0	6,132	1,680	1,680	0	0	0
DX FAN COIL UNITS (5)	103	73	8,246	10,990	13,741	5,890	7,855	9,815
DX A/C UNITS (2)	64	46	25,830	8,491	8,491	18,195	6,065	6,065
TOTALS	536	1,259	67,401	47,109	61,588	95,179	103,320	173,940

Electric Cost = $51,900

Non- Summer:

KW	$3,535	536	kw/yr * $6.60/kw
Off-peak KWH	$2,494	67,401	kwh/yr * $0.037/kwh
Intermediate KWH	$2,167	47,109	kwh/yr * $0.046/kwh
On- peak KWH	$3,264	61,588	kwh/yr * $0.053/kwh

Summer:

KW	$21,515	1,259	kw/yr * $17.09/kw
Off-peak KWH	$3,236	95,179	kwh/yr * $0.034/kwh
Intermediate KWH	$4,856	103,320	kwh/yr * $0.047/kwh
On- peak KWH	$10,784	173,940	kwh/yr * $0.062/kwh

Totals $51,851

ECO-E

SHUTDOWN CHILLERS DURING WINTER & SUMMER UNOCCUPIED PERIODS

#	DESCRIPTION	QUAN.	UNITS	MATERIAL $/UNIT	MATERIAL TOTAL	LABOR $/UNIT	LABOR TOTAL	LINE TOTAL	#
1	MECHANICAL								1
2	AC-1	1	EA	$15,000	$15,000	$2,000	$2,000	$17,000	2
3	AC-3	1	EA	$8,500	$8,500	$1,300	$1,300	$9,800	3
4	FC-1	1	EA	$6,400	$6,400	$2,100	$2,100	$8,500	4
5	FC-2	1	EA	$3,200	$3,200	$900	$900	$4,100	5
6	FC-3	1	EA	$2,000	$2,000	$500	$500	$2,500	6
7	FC-4	1	EA	$2,000	$2,000	$500	$500	$2,500	7
8	FC-5	1	EA	$3,500	$3,500	$1,100	$1,100	$4,600	8
9	PIPING &ACCESSORIES	1	LS	$2,500	$2,500	$2,500	$2,500	$5,000	9
10	ELECTRICAL	1	LS	$2,500	$2,500	$3,000	$3,000	$5,500	10
11	CONTROLS	1	LS	$1,000	$1,000	$1,000	$1,000	$2,000	11
12	DEMOLITION	1	LS	$300	$300	$4,700	$4,700	$5,000	12
13					$0		$0	$0	13
14					$0		$0	$0	14
15					$0		$0	$0	15
16					$0		$0	$0	16
17					$0		$0	$0	17
18					$0		$0	$0	18
19					$0		$0	$0	19
20					$0		$0	$0	20
21					$0		$0	$0	21
22					$0		$0	$0	22
23					$0		$0	$0	23
24					$0		$0	$0	24
25					$0		$0	$0	25
26					$0		$0	$0	26
27					$0		$0	$0	27
28					$0		$0	$0	28
29					$0		$0	$0	29
30					$0		$0	$0	30
31					$0		$0	$0	31
32					$0		$0	$0	32
33					$0		$0	$0	33
34					$0		$0	$0	34
35					$0		$0	$0	35
36					$0		$0	$0	36
37					$0		$0	$0	37
38					$0		$0	$0	38
39					$0		$0	$0	39
40					$0		$0	$0	40
41					$0		$0	$0	41
42					$0		$0	$0	42
43					$0		$0	$0	43
44					$0		$0	$0	44
45					$0		$0	$0	45
46					$0		$0	$0	46
47					$0		$0	$0	47
48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53					$0		$0	$0	53
54	CONTINGENCY 20%				$9,380		$3,920	$13,300	54
55					$0		$0	$0	55
56	**TOTALS>>>>>>>>>**				**$56,000**		**$24,000**	**$80,000**	56

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ECO-F
Security Room

Existing. According to design drawings, Room 1A129, located on the first floor, is designated as the security Room while Room 1A132 (adjacent) is designated as telephones. Air conditioning for the telephone room is supplied by air handling unit AHU-3. An independent fan coil unit, FC-5, furnishes air conditioning for the security room. Presently, the security room is occupied 24 hours per day.

During site investigations it was found that security personnel were occupying the telephone room while the telephone equipment was installed in the original security room. However, the mechanical systems were not altered. AHU-3 is operated 24 hours per day to satisfy the air conditioning needs of the security room. Total annual cost to operate FC-5 and AHU-3, including weekends and normal unoccupied hours, is $7,300. These costs were developed in the electric model and are summarized below:

Off-Peak Usage	=	70,082 kWh
Intermediate Usage	=	24,775 kWh
On-Peak Usage	=	24,775 kWh
Summer kW	=	85 kW
Non-Summer kW	=	120 kW

Refer to the attached Existing Energy Usage Table for a more detailed breakdown of operating costs.

Proposed. Install a split system DX fan coil unit for the security room and install an exhaust fan for ventilation air. The exhaust fan will draw air from the surrounding spaces to the security room for ventilation. Also shut down FC-5 and AHU-3 during weekends and unoccupied hours. This will lower annual energy cost by decreasing electric usage for the air handlers. Annual energy cost for the systems will be reduced to $5,900.

Off-Peak kWh	=	19,526 kWh
Intermediate kWh	=	18,551 kWh
On-Peak kWh	=	30,367 kWh
Summer kW	=	100 kW
Non-Summer kW	=	140 kW

Refer to the attached Proposed Energy Usage Table for a more detailed breakdown of operating costs.

Construction Cost. The expected construction cost for this project is $12,000. (Reference attached cost estimate).

Material	$5,500
Labor	$5,300
Engineering	$1,200

Savings. The annual cost savings resulting from the implementation of this project will be $1,400 ($7,300 - $5,900).

Off-Peak kWh	=	50,556 kWh (70,082 kWh - 19,526 kWh)
Intermediate kWh	=	6,124 kWh (24,775 kWh - 18,551 kWh)
On-Peak kWh	=	-5,542 kWh (24,775 kWh - 30,367 kWh)
Summer kW	=	-15 kW (85 kW - 100 kW)
Non-Summer kW	=	-20 kW (120 kW - 140 kW)

Energy Usage	=	175 mmBtu ((50,556 kWh + 6,124 kWh - 5,542 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu
Btu/sf	=	717 mmBtu ((50,556 kWh + 6,124 kWh - 5,542 kWh) x 3,413 Btu/kWh) ÷ 234,450 sf

Discussion. The expected payback resulting from the implementation of this project is 8.6 years ($12,000 ÷ $1,400). There is no additional monetary savings due to reduced maintenance.

ECO-F
EXISTING ENERGY USAGE TABLE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
AHU-3 SF	79	56	26,775	9,450	9,450	19,125	6,750	6,750
AHU-3 RF	39	28	13,388	4,725	4,725	9,563	3,375	3,375
FC-5	2	1	718	277	277	513	198	198
TOTALS	120	85	40,881	14,452	14,452	29,201	10,323	10,323

Electric Cost =	$7,300		
Non- Summer:			
KW	$792	120	kw/yr * $6.60/kw
Off-peak KWH	$1,513	40,881	kwh/yr * $0.037/kwh
Intermediate KWH	$665	14,452	kwh/yr * $0.046/kwh
On- peak KWH	$766	14,452	kwh/yr * $0.053/kwh
Summer:			
KW	$1,453	85	kw/yr * $17.09/kw
Off-peak KWH	$993	29,201	kwh/yr * $0.034/kwh
Intermediate KWH	$485	10,323	kwh/yr * $0.047/kwh
On- peak KWH	$640	10,323	kwh/yr * $0.062/kwh
Totals	$7,306		

ECO-F

PROPOSED ENERGY USAGE TABLE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
AHU-3 SF	79	56	3,150	5,250	9,450	2,250	3,750	6,750
AHU-3 RF	39	28	1,575	2,625	4,725	1,125	1,875	3,375
FC - 5	2	1	113	151	277	81	108	198
FAN COIL UNIT	20	14	6,300	2,625	3,150	4,500	1,975	2,250
EXHAUST FAN	1	1	252	112	112	180	80	80
TOTALS	140	100	11,390	10,763	17,714	8,136	7,788	12,653

Electric Cost =		$5,900	
Non- Summer:			
	KW	$926	140 kw/yr * $6.60/kw
	Off-peak KWH	$421	11,390 kwh/yr * $0.037/kwh
	Intermediate KWH	$495	10,763 kwh/yr * $0.046/kwh
	On- peak KWH	$939	17,714 kwh/yr * $0.053/kwh
Summer:			
	KW	$1,700	100 kw/yr * $17.09/kw
	Off-peak KWH	$277	8,136 kwh/yr * $0.034/kwh
	Intermediate KWH	$366	7,788 kwh/yr * $0.047/kwh
	On- peak KWH	$784	12,653 kwh/yr * $0.062/kwh
	Totals	$5,909	

ECO-F
SECURITY ROOM DX UNITS

#	DESCRIPTION	QUAN.	UNITS	MATERIAL $/UNIT	MATERIAL TOTAL	LABOR $/UNIT	LABOR TOTAL	LINE TOTAL	#
1	MECHANICAL								1
2	EXHAUST FAN	1	EA	$200	$200	$100	$100	$300	2
3	FAN COIL UNIT	1	EA	2600	$2,600	1200	$1,200	$3,800	3
4	DUCTWORK & ACCESSORIES	1	LS	$200	$200	$400	$400	$600	4
5	PIPING & ACCESSORIES	1	LS	$900	$900	$1,500	$1,500	$2,400	5
6	ELECTRICAL	1	LS	$500	$500	$500	$500	$1,000	6
7	CONTROLS	1	LS	100	$100	200	$200	$300	7
8	DEMOLITION	1	LS	100	$100	500	$500	$600	8
9					$0		$0	$0	9
10					$0		$0	$0	10
11					$0		$0	$0	11
12					$0		$0	$0	12
13					$0		$0	$0	13
14					$0		$0	$0	14
15					$0		$0	$0	15
16					$0		$0	$0	16
17					$0		$0	$0	17
18					$0		$0	$0	18
19					$0		$0	$0	19
20					$0		$0	$0	20
21					$0		$0	$0	21
22					$0		$0	$0	22
23					$0		$0	$0	23
24					$0		$0	$0	24
25					$0		$0	$0	25
26					$0		$0	$0	26
27					$0		$0	$0	27
28					$0		$0	$0	28
29					$0		$0	$0	29
30					$0		$0	$0	30
31					$0		$0	$0	31
32					$0		$0	$0	32
33					$0		$0	$0	33
34					$0		$0	$0	34
35					$0		$0	$0	35
36					$0		$0	$0	36
37					$0		$0	$0	37
38					$0		$0	$0	38
39					$0		$0	$0	39
40					$0		$0	$0	40
41					$0		$0	$0	41
42					$0		$0	$0	42
43					$0		$0	$0	43
44					$0		$0	$0	44
45					$0		$0	$0	45
46					$0		$0	$0	46
47					$0		$0	$0	47
48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53					$0		$0	$0	53
54					$0		$0	$0	54
55	CONTINGENCY 20%				$920		$880	$1,800	55
56					$0		$0	$0	56
57	**TOTALS>>>>>>>>>**				**$5,500**		**$5,300**	**$10,800**	57

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ECO-G
Variable Frequency Drive Controllers

Existing.

Air handling unit systems AHU-4,5, & 8 are VAV systems with some terminal reheat. As terminal VAV boxes close, a main bypass damper opens to relieve supply air to the return duct. A bypass damper controlled by a pressure sensor varies the bypass air flow according to supply air pressure. The supply and return fans run at a constant volume of air at all times.

From the electric model and summarized on the attached table, the total annual demand is 694 kW and usage is 492,632 kWh for all three (3) units. Annual electric cost for these air handlers is $28,600.

Off-Peak kWh	=	289,080 kWh
On-Peak kWh	=	101,702 kWh
Intermediate kWh	=	101,850 kWh
Summer kW	=	301 kW
Non-Summer kW	=	393 kW

Refer to the attached table for a more detailed breakdown of energy usage and costs.

Proposed.

In order to take advantage of the air flow variation and reduce fan electric usage, install a variable frequency drive on each fan motor The new drives will vary the flow depending on system pressure. According to building personnel, the building is occupied for approximately ten hours during weekdays and unoccupied on weekends. The units should be controlled to operate in the occupied cycle during the day and unoccupied cycle at night. The unit can potentially operate at 100% flow for only 45% of the day. For the purpose of this analysis, it is assumed, on average, air flow will be reduced to 75% of total volume during the day. The estimated reduction of air flow by 25% will lower annual electric usage to 280,853 kWh. Electric demand is not expected to be reduced. This is based upon the fact that the air handlers will be operating at full capacity during portions of peak demand time periods. The annual electric cost for these two three handling systems will be $19,700.

Supply Air Fans (3)
HP @ 75% Air Flow= 30 HP ((70HP x $(44{,}055\text{cfm})^3$) ÷ ($(58{,}740\text{cfm})^3$)

Return Air Fans (3)
HP @ 75% air Flow= 16 HP ((37.5HP x $(37{,}642\text{cfm})^3$) ÷ ($(50{,}190\text{cfm})^3$)

Percent Reduction = 57% ((10.75HP - 46HP) ÷ 107.5HP)

Non-Summer Electric Usage

Demand kW = 393 kW

Off-Peak kWh = 96,119 kWh (168,630 kWh x 0.57)

Intermediate kWh = 30,592 kWh (53,670 kWh x 0.57)

On-Peak kWh = 30,508 kWh (53,522 kWh x 0.57)

Electric Cost = $9,200 (393 kW x $6.60/kW + 96,119 kWh x $0.037/kWh + 30,592 kWh x $0.046/kWh + 30,508 kWh x $0,053/kWh = $9,174, use $9,200)

Summer Electric Usage

Demand kW = 301 kW

Off-Peak kWh = 68,708 kWh (120,540 kWh x 0.57)

Intermediate kWh = 27,463 kWh (48,180 kWh x 0.57)

On-Peak kWh	=	27,463 kWh (48,180 kWh x 0.57)
Electric Cost	=	\$10,500 (301 kW x \$17.09/kW + 68,708 kWh x \$0.034/kWh + 27,463 kWh x \$0.047/kWh + 27,463 kWh x \$0,062/kWh = \$10,474, use \$10,500)

Construction Cost. The expected construction cost for the project is \$110,000. (Reference attached cost estimate).

Material	\$59,000
Labor	\$39,000
Engineering	\$12,000

Savings. The annual cost savings resulting from the implementation of this project will be \$8,900 (\$28,600 - \$19,700).

Off-Peak kWh	=	124,253 kWh (289,080 kWh - 164,827 kWh)
On-Peak kWh	=	43,731 kWh (101,702 kWh - 57,971 kWh)
Intermediate kWh	=	43,795 kWh (101,850 kWh - 58,055 kWh)
Summer kW	=	0 kW (301 kW - 301 kW)
Non-Summer kW	=	0 kW (393 kW - 393 kW)
Energy Savings	=	723 Btu/sf ((124,253 kWh + 43,731 kWh + 43,795 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu
Btu/sf	=	2,969 mmBtu ((124,253 kWh + 43,731 kWh + 43,795 kWh) x 3,413 Btu/kWh) ÷ 234,450 sf

Discussion. The expected payback resulting from the implementation of this project is 12.4 years (\$110,000 ÷ \$8,900). Isolation transformers will be installed along with the controllers to prevent the drives from transmitting electrical disturbances to the remainder of the building's electrical distribution system.

EC0-G
EXISTING ENERGY USAGE

DESCRIPTION	AIR FLOW CFM	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
AHU-4, 15 HP	11,040	55	42	23,520	7,840	7,840	16,800	6,720	6,720
AHU-4, 7.5 HP	10,000	27	21	11,760	3,920	3,920	8,400	3,360	3,360
AHU-5, 30 HP	26,400	110	84	47,040	14,784	13,888	33,600	13,440	13,440
AHU-5, 15 HP	21,000	55	42	23,520	7,392	6,944	16,800	6,720	6,720
AHU-8, 25 HP	21,300	92	70	39,270	12,342	13,090	28,050	11,220	11,220
AHU-8, 15 HP	19,190	55	42	23,520	7,392	7,840	16,800	6,720	6,720
TOTALS		393	301	168,630	53,670	53,522	120,450	48,180	48,180

Electric Cost =		$28,600	
Non- Summer:			
	KW	$2,592	393 kw/yr * $6.60/kw
	Off-peak KWH	$6,239	168,630 kwh/yr * $0.037/kwh
	Intermediate KWH	$2,469	53,670 kwh/yr * $0.046/kwh
	On- peak KWH	$2,837	53,522 kwh/yr * $0.053/kwh
Summer:			
	KW	$5,144	301 kw/yr * $17.09/kw
	Off-peak KWH	$4,095	120,450 kwh/yr * $0.034/kwh
	Intermediate KWH	$2,264	48,180 kwh/yr * $0.047/kwh
	On- peak KWH	$2,987	48,180 kwh/yr * $0.062/kwh
	Totals	$28,628	

ECO-G
CONSTRUCTION COST ESTIMATE

#	DESCRIPTION	QUAN.	UNITS	MATERIAL		LABOR		LINE	#
				$/UNIT	TOTAL	$/UNIT	TOTAL	TOTAL	
1	MECHANICAL								1
2	VARIABLE FREQ DRIVES 7.5 HP	1	EA	$3,600	$3,600	$1,000	$1,000	$4,600	2
3	15 HP	3	EA	$4,500	$13,500	$1,000	$3,000	$16,500	3
4	25 HP	1	EA	$6,400	$6,400	$1,000	$1,000	$7,400	4
5	30 HP	1	EA	$8,600	$8,600	$1,000	$1,000	$9,600	5
6	ELECTRICAL	1	LOT	$5,000	$5,000	$10,000	$10,000	$15,000	6
7	CONTROLS	6	EA	$750	$4,500	$750	$4,500	$9,000	7
8	BALANCING	6	LS	$0	$0	$800	$4,800	$4,800	8
9	ISOLATION TRANSFORMER 7.5 HP	1	EA	$700	$700	$1,000	$1,000	$1,700	9
10	ISOLATION TRANSFORMER 15 HP	3	EA	$800	$2,400	$1,000	$3,000	$5,400	10
11	ISOLATION TRANSFORMER 25 HP	1	EA	$1,200	$1,200	$1,000	$1,000	$2,200	11
12	ISOLATION TRANSFORMER 30 HP	1	EA	$1,300	$1,300	$1,000	$1,000	$2,300	12
13	STATIC PRESSURE CONTROLLER	3	EA	$500	$1,500	$500	$1,500	$3,000	13
14					$0		$0	$0	14
15					$0		$0	$0	15
16					$0		$0	$0	16
17					$0		$0	$0	17
18					$0		$0	$0	18
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29					$0		$0	$0	29
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37					$0		$0	$0	37
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39					$0		$0	$0	39
40					$0		$0	$0	40
41					$0		$0	$0	41
42					$0		$0	$0	42
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44					$0		$0	$0	44
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47					$0		$0	$0	47
48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53					$0		$0	$0	53
54					$0		$0	$0	54
55	CONTINGENCY				$10,300		$6,200	$16,500	55
56							$0	$0	56
57	**TOTALS>>>>>>>>>**				**$59,000**		**$39,000**	**$98,000**	57

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ENTECH ENGINEERING INC. 24-Aug-95

ECO-H
Peak Saving with Diesel Generator

Existing. A central chilled water system provides chilled water to Marshall Hall. The chilled water system incorporates two (2) chillers, a 400 ton and a 250 ton.

The chillers are operated all year. From October 1993 to September 1994, only the 250 ton chiller operated. The 400 ton chiller was out of service. From the electric model of Section 5, the chiller had an annual demand of 1,431 kW and usage of 808,737 kWh. The annual energy cost for the operation of the chillers is $54,900.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	476	149,057	52,224	76,563	$15,117
Summer	955	272,294	123,193	135,406	$39,764
Totals	1,431	421,351	175,417	211,969	$54,900

Proposed. General: Install one (1) new diesel generator which will produce electricity for the 400 ton chiller. The generator will operate only during the on-peak period during the summer billing months. In general the generator will operate from 12:00 noon to 8:00 pm, Monday through Friday, from June 1 to October 31.

Generator: A new 350 kVa diesel generator will be installed near the main mechanical room. The generator will directly feed the 400 ton electric chiller.

Transfer Switch/Controls: The generator will be provided with an automatic transfer switch and controls for the chiller. This will enable the chiller to be switched automatically from normal to power to generated power. The controls will operate the generators from 12:00 p.m. to 8:00 p.m., Monday through Friday. These times are the on-peak billing period. When the peak period is over, the chillers will be supplied by normal power.

Other: The existing fuel oil tank will be used to supply the generator. It is estimated that the maximum fuel consumption for on (1) day would be 200 gallons.

The system will eliminate chiller on-peak usage and demand costs. The generators will now provide the on-peak power. The chiller demand will remain the same, but the cost will be less. An incremental cost of $6.60/kW will still be incurred for maximum demand which can occur regardless of time of day. Therefore, there will still be a demand charge but a lower rate The chiller/generator system is estimated to have an annual energy cost of $43,200.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	476	149,057	52,224	76,563	$15,117
Summer	955	272,294	123,193	0	$21,351
Totals	1,431	421,351	175,417	76,563	$36,500

Fuel Oil Usage = 11,107 gal ((135,406 kWh x 3,413 Btu/kWh) ÷ (138,690 Btu/gal x 30% eff for gen) = 11,107 gal)

Fuel Oil Cost = $4,700 (11,107 gal x $0.60/gal = $6,664, use $6,700)

Total Cost = $43,200 ($36,500 + $6,700)

Construction Cost.	The estimated construction cost for this project is $145,000. (Reference attached cost estimate).

Material	$100,000
Labor	$ 30,000
Engineering	$ 15,000

Savings. The annual cost savings resulting from the implementation of this project will be $11,700 ($54,900 - $43,200).

Off-Peak kWh	=	0 kWh (421,351 kWh - 421,351 kWh)
Intermediate kWh	=	0 kWh (175,417 kWh - 175,417 kWh)
On-Peak kWh	=	135,406 kWh (211,969 kWh - 76,563 kWh)
Demand	=	0 kW (1,431 kW - 1,431 kW)
Fuel Oil Usage	=	-11,107 gal (0 gal - 11,107 gal)
Energy Usage	=	-1,078 mmBtu (135,406 kWh x 3,413 Btu/kWh - 11,107 gal x 138,690 Btu/gal) ÷ 1,000,000 Btu/mmBtu)
Btu/sf	=	-4,429 Btu/sf (135,406 kWh x 3,413 Btu/kWh - 11,107 gal x 138,690 Btu/gal) ÷ 243,450 sf)

Discussion. On an energy savings basis the payback period for this ECO is 12.4 years ($145,000 ÷ $11,700). It is expected that this new system will require more maintenance. Entech estimates annual maintenance costs to increase by $1,000 per year. It is important to provide proper preventative maintenance to the generator. If the generator experiences an unscheduled shutdown, most of the ratchet savings could be lost. In order to provide more reliability, it may be possible to install two (2) smaller generators rather than one (1) large generator. In addition, this ECO cannot be combined with pepco's curtailment program. Under this ECO, the generator would already be operating during the on-peak period and not be capable of curtailing any further.

ECO-H
PEAK SHAVING WITH DIESEL GENERATOR

#	DESCRIPTION	QUAN.	UNITS	MATERIAL $/UNIT	MATERIAL TOTAL	LABOR $/UNIT	LABOR TOTAL	LINE TOTAL	#
1									1
2	350 KVA DIESEL GENERATOR	1	EA	$62,000	$62,000	$6,700	$6,700	$68,700	2
3	AUTOMATIC XFER SW 3P/	1	EA	$5,000	$5,000	$700	$700	$5,700	3
4	WEATHER AND SOUND ENCLOSURE	1	EA	$8,000	$8,000	$2,000	$2,000	$10,000	4
5	CONCRETE PAD 9' X 14' X 2'	10	CY	$120	$1,200	$100	$1,000	$2,200	5
6	DIESEL PIPING	100	LF	$35	$3,500	$50	$5,000	$8,500	6
7	ELECTRICAL REQUIREMENTS	1	EA	$5,000	$5,000	$10,000	$10,000	$15,000	7
8				$0	$0	$0	$0	$0	8
9				$0	$0	$0	$0	$0	9
10				$0	$0	$0	$0	$0	10
11				$0	$0	$0	$0	$0	11
12				$0	$0	$0	$0	$0	12
13				$0	$0	$0	$0	$0	13
14				$0	$0	$0	$0	$0	14
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16				$0	$0	$0	$0	$0	16
17				$0	$0	$0	$0	$0	17
18				$0	$0	$0	$0	$0	18
19				$0	$0	$0	$0	$0	19
20				$0	$0	$0	$0	$0	20
21				$0	$0	$0	$0	$0	21
22				$0	$0	$0	$0	$0	22
23				$0	$0	$0	$0	$0	23
24				$0	$0	$0	$0	$0	24
25				$0	$0	$0	$0	$0	25
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48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53	CONTINGENCY				$15,300		$4,600	$19,900	53
54					$0		$0	$0	54
55									55
	TOTALS>>>>>>>>>				**$100,000**		**$30,000**	**$130,000**	

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ENTECH ENGINEERING INC. 24-Aug-95

ECO-I
Chilled Water Storage

Existing. A central chilled water system provides chilled water to Marshall Hall. The chilled water system incorporates two (2) chillers, a 400 ton and a 200 ton chiller.

The chillers are operated all year. From October 1993 to September 1994 only, the 250 ton chiller operated. The 400 ton chiller was out of service. From the electric models in Attachment Section, the chillers have an annual demand of 1,431 kW and usage of 808,737 kWh. The annual energy cost for the operation of the chillers is $54,900.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	476	149,057	52,224	76,563	$15,117
Summer	955	272,294	123,193	135,406	$39,764
Totals	1,431	421,351	175,417	211,969	$54,900

Proposed. Utilize the 400 ton chiller to produce and store chilled water during utility off-peak periods when the cost for electricity is lower. Install equipment to store 1,890 ton-hour of chilled water for use during on-peak periods. This amount of storage is equivalent to a 22,000 gallon storage tank.

During the on-peak period (12:00 p.m. to 8:00 p.m.), the stored chilled water will be utilized to meet the load. The chiller will not operate during the on-peak period. During the off-peak and intermediate periods (8:00 p.m. to 12:00 p.m.), the 400 ton chiller will operate to meet to load and produce chilled water for storage. The storage system will be used from June to October during the summer electric rate period.

For this analysis, 100% storage was assumed. Therefore, the storage was sized so that during the on-peak period 100% of the cooling will be provided by the stored chilled water. On cooler days, a portion of the stored chilled water may be used to satisfy loads during the intermediate period. Use of the chilled water storage system will reduce demand charges. Generating cooling at night also takes advantages of the lower off-peak cost of energy (kWh). Refer to the attached kW Demand Table and July Peak Day Cooling Load Profile 100% Storage. With the new chilled water storage system the on-peak kWh will be shifted to off-peak and intermediate hours. The annual building energy cost is $44,600.

Season	Demand kW	Off-Peak kWh	Intermediate kWh	On-Peak kWh	Cost $
Non-Summer	476	149,057	52,224	76,563	$15,564
Summer	1,287	339,997	190,896	0	$29,026
Totals	1,763	489,054	243,120	76,563	$44,600

Off-Peak kWh = 339,997 kWh (272,294 kWh + (135,406 kWh ÷ 2))

Intermediate kWh = 170,968 kWh (123,193 kWh + (95,550 kWh ÷ 2))

Construction Cost. The expected construction cost is $290,000. (See attached cost breakdown.

Material	$ 150,000
Labor	$ 110,000
Engineering	$ 30,000

Savings. The annual cost savings resulting from the implementation of this project will be $10,300 ($54,900 - $44,600).

Summer kW = -332 kW (1,431 kW - 1,764 kW)

Off-Peak kWh	=	-67,703 kWh (421,351 kWh - 489,054 kWh)
Intermediate kWh	=	-67,703 kWh (175,417 kWh - 243,120 kWh)
On-Peak Usage	=	135,406 kWh (211,969 kWh -76,563 kWh)
Energy Usage	=	0 mmBtu (((-67,703 kWh - 67,703 kWh + 135,406 kWh) x 3,413 Btu/kWh) ÷ 1,000,000 Btu/mmBtu]
Btu/sf	=	0 Btu/sf (-67,703 kWh - 67,703 kWh + 135,406 kWh) x 3,413 Btu/kWh) ÷ 243,450 sf

Discussion. The expected payback resulting from the implementation of this project is 28.2 years ($290,000÷$10,300). There is no additional monetary savings due to reduced maintenance.

ECO-I
CHILLED WATER STORAGE

#	DESCRIPTION	QUAN.	UNITS	MATERIAL $/UNIT	MATERIAL TOTAL	LABOR $/UNIT	LABOR TOTAL	LINE TOTAL	#
1									1
2	STORAGE TANK 220,000 GAL	1	EA	$100,000	$100,000	$60,000	$60,000	$160,000	2
3	CONTROLS	6	PTS	$750	$4,500	$750	$4,500	$9,000	3
4	PUMP	1	EA	$1,500	$1,500	$500	$500	$2,000	4
5	PIPING 6"	250	LF	$30	$7,500	$50	$12,500	$20,000	5
6	EXCAVATION	1500	CY	$2	$3,000	$6	$9,000	$12,000	6
7	CONTROL VALVE	2	EA	$2,000	$4,000	$400	$800	$4,800	7
8					$0		$0	$0	8
9					$0		$0	$0	9
10					$0		$0	$0	10
11					$0		$0	$0	11
12					$0		$0	$0	12
13					$0		$0	$0	13
14					$0		$0	$0	14
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17					$0		$0	$0	17
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30					$0		$0	$0	30
31					$0		$0	$0	31
32					$0		$0	$0	32
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45					$0		$0	$0	45
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48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53	CONTINGENCY				$29,500		$22,700	$52,200	53
54					$0		$0	$0	54
55	**TOTALS>>>>>>>>**				**$150,000**		**$110,000**	**$260,000**	55

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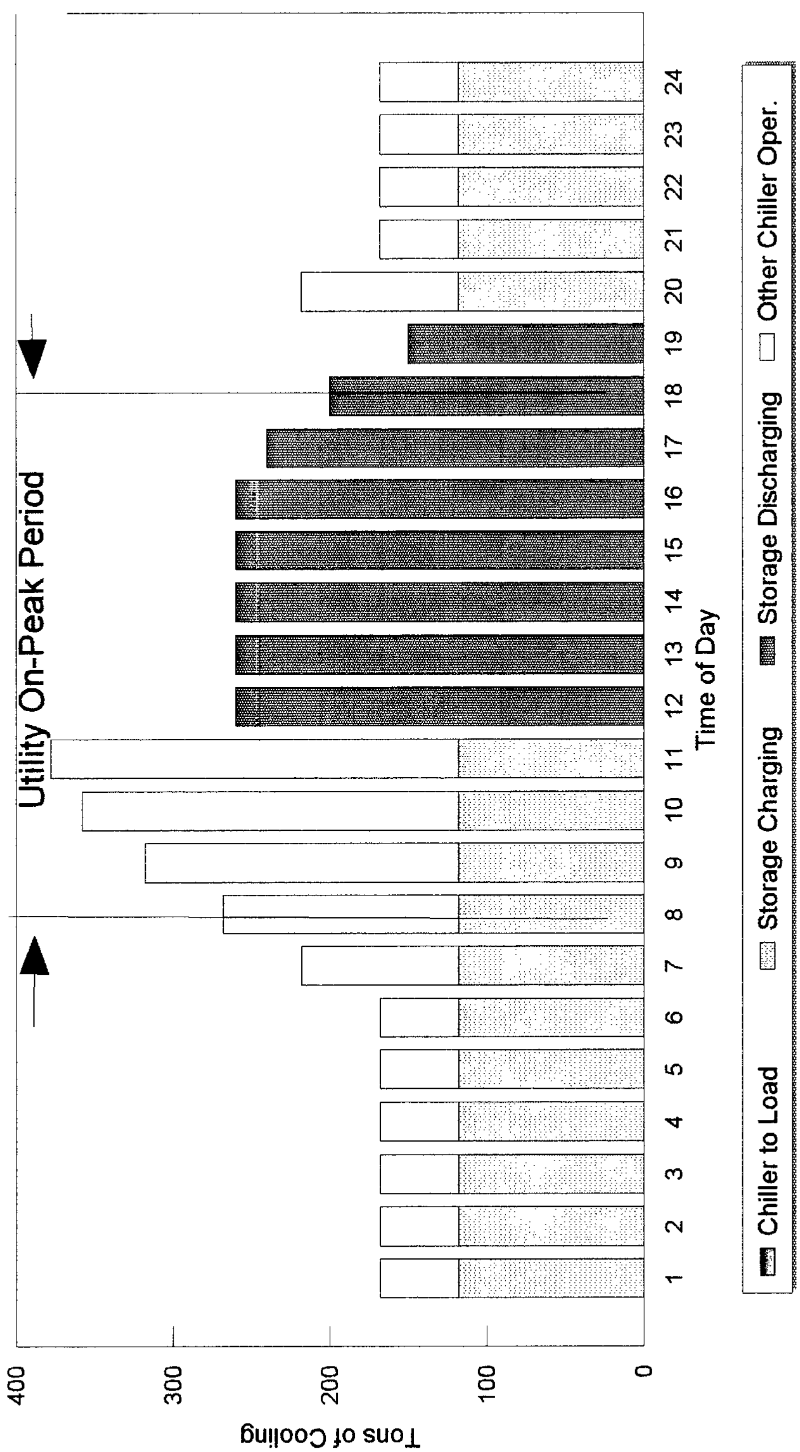
ENTECH ENGINEERING INC. 25-Aug-95



Utility On-Peak Period
Tons of Cooling
0
100
200
300
400
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time of Day
Chiller to Load
Storage Charging
Storage Discharging
Other Chiller Oper.

ECO-J
Oxygen (O_2) Trim Controls on Boilers

Existing

Currently the two steam boilers have no oxygen trim controls on the burners. Absence of these controls allows excessive combustion air to be heated, resulting in increased flue gas losses. The theoretical amount of air needed for combustion for gas burners is 720 lbs of air/million Btu (mmBtu). Typically without oxygen trim controls, boilers tend to use 35% excess air or 252 lbs/mmBtu.

Excess Air = 252 lbs/mmBtu (720 lbs/mmBtu x .35 = 252 lbs/mmBtu).

From the billing histories, 11,230 mcf of natural gas was used by the boilers from October 1992 through September 1993, for a total of 11,567 mmBtu.

Energy Usage = 11,567 mmBtu (11,230 mcf/yr x 1.03 mmBtu/mcf = 11,567 mmBtu/yr).

The amount of energy lost due to excess air being heated is 18,144 Btu/mmBtu.

Energy Lost = 18,144 Btu/mmBtu ((252 lbs/mmBtu x .24 specific heat of air x (350 deg. F stack temp. - 50 deg. avg. ambient air) = 18,144 Btu/mmBtu)).

The total annual energy lost is 210 mmBtu. Equivalent annual gas usage is 204 mcf and annual cost is $1,600.

Energy Usage = 210 mmBtu/yr (18,144 Btu/mmBtu x 11,230 mmBtu/yr ÷ 1,000,000 Btu/mmBtu = 209 mmBtu/yr).

Gas Usage	=	204 mcf/yr (209 mmBtu/yf ÷ 1.03 mmBtu/mcf = 203 mcf/yr).
Gas Cost	=	$1,600/yr (204 mcf/yr x $7.83/mcf = $1,597, $1,600/yr).

Proposed

Install oxygen (O_2) trim controls on the boilers to reduce the amount of excess combustion air being lost in the flue gas. By installing the controls, excess air can be reduced to approximately 10% or 72 lb/mmBtu. The amount of energy lost can be reduced to 61 mmBtu/yr. Equivalent gas usage will be 59 mcf/yr for a total cost of $500/yr.

Excess Air	=	72 lb/mmBtu (720 lbs/mmBtu x .10 = 72 lbs./mmBtu).
Energy Lost	=	5,184 Btu/mmBtu ((72 lb/mmBtu x .24 x (350° F - 50° F.) = 5,184 mmBtu/Btu.))
Energy Usage	=	60 mmBtu/yr (5,182 Btu/mmBtu x 11,567 mmBtu/yr ÷ 1,000,000 Btu/mmBtu = 60 mmBtu/yr).
Gas Usage	=	58 mcf (61 mmBtu/yr ÷ 1.03 mmBtu/mcf = 58 mcf/yr).
Gas Cost	=	$500 (58 mcf/yr x $7.83/mcf = $460/yr = $454, use $500)

Construction Cost

The estimated construction cost for this project is $22,000.

Material	$15,000
Labor	$ 5,000
Engineering	$ 2,000

Savings

The cost savings resulting from the implementation of this project is $1,100 ($1,600 - $500).

Gas Usage	=	146 mcf/yr (204 mcf/yr - 58 mcf/yr)
Energy Usage	=	150 mmBtu/yr (210 mmBtu/yr - 60 mmBtu/yr)
Btu/sf	=	616 Btu/sf (150 mmBtu x 1,000,000 Btu/mmBtu ÷ 243,450 sf)

Discussion The simple payback period is 20.0 years ($22,000÷$1,100). There is no additional monetary savings due to reduced maintenance.

ECO-J
OXYGEN TRIM CONTROLS ON BOILERS

#	DESCRIPTION	QUAN.	UNITS	MATERIAL		LABOR		LINE	#
				$/UNIT	TOTAL	$/UNIT	TOTAL	TOTAL	
1									1
2	OXYGEN TRIM CONTROLS	1	EA	$15,000	$15,000	$5,000	$5,000	$20,000	2
3					$0		$0	$0	3
4					$0		$0	$0	4
5					$0		$0	$0	5
6					$0		$0	$0	6
7					$0		$0	$0	7
8					$0		$0	$0	8
9					$0		$0	$0	9
10					$0		$0	$0	10
11					$0		$0	$0	11
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52					$0		$0	$0	52
53					$0		$0	$0	53
54					$0		$0	$0	54
55					$0		$0	$0	55
56									56
	TOTALS>>>>>>>>>				**$15,000**		**$5,000**	**$20,000**	

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ENTECH ENGINEERING INC. 24-Aug-95

ECO-K
PEPCO's Curtailment Program

Existing.

pepco currently has a curtailment program which is available for the General Service rate which Marshall Hall uses. This rider enables customers to receive credits for displacing electric loads when requested by the company. In general, customers will turn off electric loads to lower their electric demand to a predetermined load (firm demand) when the company requests. A credit of $8.29 (high voltage customers) will be applied to the difference between the month's billing demand and the customer's firm demand. The customer can incur a penalty if its demand is not reduced to the firm demand during curtailment. A penalty of 2 times the credit will be applied to the difference between the firm demand and demand during curtailment. The following summarizes the curtailment program.

Months in Effect	June - October
Time Period	On-Peak Period
Hrs/Curtailment	6 hrs each
# per Year	15 per year
Minimum Load	100 kW
Credit $/kW	$8.29 (Billed kW - Firm)
Penalty $/kW	$16.58 (Demand during Curtailment - Firm)

Proposed.

General: Apply for the curtailment program. A firm demand level of 1,000 kW should be selected. During the summer months demand is typically around 1,200 kW. In order to achieve this level, install one (1) new diesel generator which will produce electricity for the 400 ton chiller. The generator will operate only during the on-peak period during the summer billing months. In general the generator will capable of operating from 12:00 noon to 8:00 pm, Monday through Friday, from June 1 to October 31 (curtailment period).

Generator: A new 350 kVa diesel generator will be installed near the main mechanical room. The generator will directly feed the 400 ton electric chiller.

Transfer Switch/Controls: The generator will be provided with an automatic transfer switch and controls for the chiller. This will enable the chiller to be switched automatically from normal to power to generated power. The controls will operate the generators from 12:00 p.m. to 8:00 p.m., Monday through Friday. These times are the on-peak billing period. When the peak period is over, the chillers will be supplied by normal power.

Other: The existing fuel oil tank will be used to supply the generator. It is estimated that the maximum fuel consumption for one (1) day would be 200 gallons.

Because the 400 ton chiller was not operational during 1993-94, 1992-93 billing data was used to project potential demand credits. For the purpose of this ECO, the maximum number of curtailments will be used. The system will allow the chiller to be removed from building demand during the curtailment period therefore receiving demand credits. The curtailment program has the potential of providing $8,400 in cost savings.

Demand Credits	=	968 kW (5,968 kW - (1,000 kW firm x 5 mo)
On-Peak kWh	=	25,200 kWh (400 tons x 0.7 kW/ton x 6 hrs x 15 curtailments)
Electric Cost	=	$9,600 (968 kW x 8.29/kW + 25,200 kWh x $0.062/kWh = $9,587, use $9,600)
Fuel Oil Usage	=	-2,067 gal ((400 tons x .7 kW/ton x 6 hrs x 15 curtailments) x 3,413 Btu/kWh ÷ 30%eff ÷ 138,690 Btu/gal) = 2,067 gal)

Fuel Oil Cost	=	-\$1,200 (2,067 gal x \$0.60/gal = \$1,240, use \$1,200)
Total Cost	=	\$8,400 (\$9,600 - \$1,200)

Construction Cost. The estimated construction cost for implementation of this project is $145,000.

Material	\$100,000
Labor	\$ 30,000
Engineering	\$ 15,000

Savings. The annual cost savings resulting from the implementation of this project will be $8,400.

Demand Credit	=	968 kW
Off-Peak kWh	=	0 kWh
Intermediate kWh	=	0 kWh
On-Peak kWh	=	25,200 kWh
Fuel Oil Usage	=	-2,067 gal (0 gal - 2,067 gal)
Energy Usage	=	-201 mmBtu (25,200 kWh x 3,413 Btu/kWh - 2,067 gal x 138,690 Btu/gal) ÷ 1,000,000 Btu/mmBtu)
Btu/sf	=	-824 Btu/sf (25,200 kWh x 3,413 Btu/kWh - 2,067 gal x 138,690 Btu/gal) ÷ 243,450 sf)

Discussion. On an energy savings basis, the payback period for this ECO is 17.3 years ($145,000 ÷ $8,400). There is no additional monetary savings due to reduced maintenance.

ECO-K
PEPCO CURTAILMENT PROGRAM

#	DESCRIPTION	QUAN.	UNITS	MATERIAL $/UNIT	MATERIAL TOTAL	LABOR $/UNIT	LABOR TOTAL	LINE TOTAL	#
1									1
2	350 KVA DIESEL GENERATOR	1	EA	$62,000	$62,000	$6,700	$6,700	$68,700	2
3	AUTOMATIC XFER SW 3P/	1	EA	$5,000	$5,000	$700	$700	$5,700	3
4	WEATHER AND SOUND ENCLOSURE	1	EA	$8,000	$8,000	$2,000	$2,000	$10,000	4
5	CONCRETE PAD 9' X 14' X 2'	10	CY	$120	$1,200	$100	$1,000	$2,200	5
6	DIESEL PIPING	100	LF	$35	$3,500	$50	$5,000	$8,500	6
7	ELECTRICAL REQUIREMENTS	1	EA	$5,000	$5,000	$10,000	$10,000	$15,000	7
8				$0	$0	$0	$0	$0	8
9				$0	$0	$0	$0	$0	9
10				$0	$0	$0	$0	$0	10
11				$0	$0	$0	$0	$0	11
12				$0	$0	$0	$0	$0	12
13				$0	$0	$0	$0	$0	13
14				$0	$0	$0	$0	$0	14
15				$0	$0	$0	$0	$0	15
16				$0	$0	$0	$0	$0	16
17				$0	$0	$0	$0	$0	17
18				$0	$0	$0	$0	$0	18
19				$0	$0	$0	$0	$0	19
20				$0	$0	$0	$0	$0	20
21				$0	$0	$0	$0	$0	21
22				$0	$0	$0	$0	$0	22
23				$0	$0	$0	$0	$0	23
24				$0	$0	$0	$0	$0	24
25				$0	$0	$0	$0	$0	25
26					$0		$0	$0	26
27					$0		$0	$0	27
28					$0		$0	$0	28
29					$0		$0	$0	29
30					$0		$0	$0	30
31					$0		$0	$0	31
32					$0		$0	$0	32
33					$0		$0	$0	33
34					$0		$0	$0	34
35					$0		$0	$0	35
36					$0		$0	$0	36
37					$0		$0	$0	37
38					$0		$0	$0	38
39					$0		$0	$0	39
40					$0		$0	$0	40
41					$0		$0	$0	41
42					$0		$0	$0	42
43					$0		$0	$0	43
44					$0		$0	$0	44
45					$0		$0	$0	45
46					$0		$0	$0	46
47					$0		$0	$0	47
48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53					$0		$0	$0	53
54					$0		$0	$0	54
55	CONTINGENCY				$15,300		$4,600	$19,900	55
56					$0		$0	$0	56
57	**TOTALS>>>>>>>>>**				**$100,000**		**$30,000**	**$130,000**	57

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ECO-L
Electric Rate Rider "GT-3B"

Existing. Marshall Hall is presently served under pepco's GT-3A Rate (Time Metered General Primary Service). Service is supplied to the building by two 13.2 kV pepco owned feeders. Two - 2,000 kVa transformers step down incoming power from 13.2 kV to 480/277v. Under the "3A" rider, the building receives a 5% discount on its electric billing. With the 5% discount the electric cost for the building from October 1993 through September 1994 was $345,300.

Proposed. Apply for pepco's "GT-3B" Rider. This rider is applicable for services which are supplied at 66 kV (high voltage). Under this rider the building would receive a total discount of 21.05% on its electric costs. Convert the incoming line from a 13.2 kV service to a 66 kV service. The existing service entrance equipment will remain. This includes the outdoor 15 kV circuit breakers, indoor transformer, duct and cable from the outdoor circuit breakers to the indoor transformers, and all relaying/metering equipment. The conversion two 66 kV will require a new outdoor substation with a two circuit incoming line structure, four air break switches, two circuit switches and two new transformers to step down from 66 kV to 13.2 kV. The secondary of the new transformers will connect to the existing outdoor 15 kV circuit breakers pepco owned feeder will also need to be replaced. The new rider will lower electric costs by an additional 16.05% (21.05% - 5%). Annual electric cost will be reduced to $287,000. There will be no reduction in electric usage and demand.

Electric Cost = $287,000 ($345,300 x (1 - .1605) = $289,880, use $289,900)

Construction Cost	The estimated construction cost for this project is $500,000. (Reference attached cost estimate)

Material	$300,000
Labor	$150,000
Engineering	$ 50,000

Savings. The cost savings resulting from the implementation of this project is $55,400 ($345,300 - $289,900).

Discussion. The payback period for this ECO is 9.0 years ($500,000/$55,400). However, the cost to replace pepco's lines is not included in this cost estimate. As of this writing it is unclear to what extent pepco would fund for the feeder replacement. In addition, as other ECOs are implemented and lower annual electric cost, the savings for this ECO are greatly reduced.

Construction Cost	The estimated construction cost for this project is $500,000. (Reference attached cost estimate)

Material	$300,000
Labor	$150,000
Engineering	$ 50,000

Savings. The cost savings resulting from the implementation of this project is $55,400 ($345,300 - $289,900).

Discussion. The payback period for this ECO is 9.0 years ($500,000÷$55,400). However, the cost to replace pepco's lines is not included in this cost estimate. As of this writing it is unclear to what extent pepco would fund for the feeder replacement. In addition, as other ECOs are implemented and lower annual electric cost, the savings for this ECO are greatly reduced.

ECO-L
ELECTRIC RIDER GT-3B

#	DESCRIPTION	QUAN.	UNITS	MATERIAL $/UNIT	MATERIAL TOTAL	LABOR $/UNIT	LABOR TOTAL	LINE TOTAL	#
1									1
2	SWITCHES, 69 KV, 600 A	2	EA	$7,000	$14,000	$3,000	$6,000	$20,000	2
3	P.T., 69 KV	2	EA	$4,000	$8,000	$2,000	$4,000	$12,000	3
4	FUSE MTG. W/UNITS	2	EA	$2,500	$5,000	$2,000	$4,000	$9,000	4
5	69 KV SWITCHGEAR	2	EA	$45,000	$90,000	$20,000	$40,000	$130,000	5
6	XFRMR 69-12KV, 2000 KVA	2	EA	$51,000	$102,000	$25,000	$50,000	$152,000	6
7	FENCE, GROUNDING, CONNECTION, ETC	1	LOT	$15,000	$15,000	$15,000	$15,000	$30,000	7
8	LOT, STEEL	1	LOT	$33,000	$33,000	$15,000	$15,000	$48,000	8
9					$0		$0	$0	9
10					$0		$0	$0	10
11					$0		$0	$0	11
12					$0		$0	$0	12
13					$0		$0	$0	13
14					$0		$0	$0	14
15					$0		$0	$0	15
16					$0		$0	$0	16
17					$0		$0	$0	17
18					$0		$0	$0	18
19					$0		$0	$0	19
20					$0		$0	$0	20
21					$0		$0	$0	21
22					$0		$0	$0	22
23					$0		$0	$0	23
24					$0		$0	$0	24
25					$0		$0	$0	25
26					$0		$0	$0	26
27					$0		$0	$0	27
28					$0		$0	$0	28
29					$0		$0	$0	29
30					$0		$0	$0	30
31					$0		$0	$0	31
32					$0		$0	$0	32
33					$0		$0	$0	33
34					$0		$0	$0	34
35					$0		$0	$0	35
36					$0		$0	$0	36
37					$0		$0	$0	37
38					$0		$0	$0	38
39					$0		$0	$0	39
40					$0		$0	$0	40
41					$0		$0	$0	41
42					$0		$0	$0	42
43					$0		$0	$0	43
44					$0		$0	$0	44
45					$0		$0	$0	45
46					$0		$0	$0	46
47					$0		$0	$0	47
48					$0		$0	$0	48
49					$0		$0	$0	49
50					$0		$0	$0	50
51					$0		$0	$0	51
52					$0		$0	$0	52
53					$0		$0	$0	53
54					$0		$0	$0	54
55	CONTINGENCY				$33,000		$16,000	$49,000	55
56					$0		$0	$0	56
57	**TOTALS>>>>>>>>**				**$300,000**		**$150,000**	**$450,000**	57

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7.0 OPERATIONS AND MAINTENANCE PRACTICES

Operations and maintenance (O&M) items are those energy conservation ideas with small costs and a payback period under one(1) year. O&M items are usually performed during the normal course of building operations. Implementation of the following O&M practices are recommended for the Marshall Hall facility.

7.1 Mechanical O&Ms

<u>Domestic Water Heater Pump Operation</u>. Presently the domestic hot water recirculation pump runs continuously, 24 hours a day, 365 days a year. The present cost to operate this pump (from the electric model) is $130 (refer to attached Table 7.1).

Off-Peak kWh	=	1,210 kWh
On-Peak kWh	=	538 kWh
Intermediate kWh	=	538 kWh
Summer kW	=	1 kW
Non-Winter kW	=	2 kW

Entech recommends using the existing time clock controller to shut off the pump during unoccupied hours. The unoccupied hours cover the electric operation during the off-peak period (12 midnight to 8:00 a.m.) and half of the intermediate period (8:00 p.m. to 12 midnight). The on-peak usage and demand would remain the same. The anticipated cost to operate this pump in the occupied period only is $70. The expected usage with the time clock is shown below.

DOMESTIC HW RECIRC PUMP
EXISTING ENERGY USAGE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
PUMP	2	1	706	314	314	504	224	224
TOTALS	2	1	706	314	314	504	224	224

Electric Cost =		$130	
Non- Summer:			
	KW	$14	2 kw/yr * $6.60/kw
	Off-peak KWH	$26	706 kwh/yr * $0.037/kwh
	Intermediate KWH	$14	314 kwh/yr * $0.046/kwh
	On- peak KWH	$17	314 kwh/yr * $0.053/kwh
Summer:			
	KW	$17	1 kw/yr * $17.09/kw
	Off-peak KWH	$17	504 kwh/yr * $0.034/kwh
	Intermediate KWH	$11	224 kwh/yr * $0.047/kwh
	On- peak KWH	$14	224 kwh/yr * $0.062/kwh
	Totals	$130	

DOMESTIC HW RECIRC PUMP
PROPOSED ENERGY USAGE

DESCRIPTION	NON-SUMMER KW	SUMMER KW	NON-SUMMER OFF-PEAK KWH	NON-SUMMER INTER. KWH	NON-SUMMER ON-PEAK KWH	SUMMER OFF-PEAK KWH	SUMMER INTER. KWH	SUMMER ON-PEAK KWH
PUMP	2	1	0	157	314	0	112	224
TOTALS	2	1	0	157	314	0	112	224

Electric Cost = $70

Non- Summer:			
	KW	$14	2 kw/yr * $6.60/kw
	Off-peak KWH	$0	0 kwh/yr * $0.037/kwh
	Intermediate KWH	$7	157 kwh/yr * $0.046/kwh
	On- peak KWH	$17	314 kwh/yr * $0.053/kwh
Summer:			
	KW	$17	1 kw/yr * $17.09/kw
	Off-peak KWH	$0	0 kwh/yr * $0.034/kwh
	Intermediate KWH	$5	112 kwh/yr * $0.047/kwh
	On- peak KWH	$14	224 kwh/yr * $0.062/kwh
	Totals	$74	

Off-Peak kWh	=	0 kWh
On-Peak kWh	=	538 kWh
Intermediate kWh	=	269 kWh
Summer kW	=	1 kW
Non-Winter kW	=	2 kW

The annual cost savings resulting from implementation of this O&M are $60 ($130 - $70). There is no construction cost incurred by the O&M.

Lower Domestic Hot Water Temperature. Presently the domestic hot water heater produces and stores water at 140°F. The present annual cost to produce domestic hot water is $2,250.

Natural Gas Usage	=	299 mcf
Natural Gas Cost	=	$2,300 (299 mcf x $7.83/mcf)

Entech recommends lowering the domestic hot water temperature to 120°F. The anticipated annual cost to produce domestic hot water is $1,750.

Natural Gas Usage	=	233 mcf
Natural Gas Cost	=	$1,800 (233 mcf x $7.83/mcf)

The annual cost savings resulting from implementation of this O&M is $500 ($2,300 - $1,800). There is no construction cost associated with this O&M.

Relocate Outdoor Air Temperature Sensor. Presently the EMCS outdoor air temperature sensor is located within the outdoor air intake duct work for air handling unit #4. When AHU-4 is not operating the outdoor air damper close

PROPOSED DOMESTIC HOT WATER USAGE CALCULATION

EXERCISE AREA (ENTIRE YEAR):

$$\frac{\frac{260\ \text{DAYS}}{\text{YEAR}} \times \frac{10\ \text{GALLON}}{\text{PERSON}} \times \frac{40\ \text{PEOPLE}}{\text{DAY}} \times \frac{8.3\ \text{LBS.}}{\text{GALLON}} \times \frac{1\ \text{BTU}}{\text{LB}} \times 70}{1{,}000{,}000\ \text{BTU/MMBTU} \times 80\%\ \text{EFFICIENCY}} = \frac{75.5\ \text{MMBTU}}{\text{YEAR}}$$

GENERAL USAGE (ENTIRE YEAR):

$$\frac{\frac{260\ \text{DAYS}}{\text{YEAR}} \times \frac{0.5\ \text{GALLON}}{\text{PERSON}} \times \frac{300\ \text{PEOPLE}}{\text{DAY}} \times \frac{8.3\ \text{LBS.}}{\text{GALLON}} \times \frac{1\ \text{BTU}}{\text{LB}} \times 70}{1{,}000{,}000\ \text{BTU/MMBTU} \times 80\%\ \text{EFFICIENCY}} = \frac{28.3\ \text{MMBTU}}{\text{YEAR}}$$

FOOD SERVICE, FULL MEAL (ENTIRE YEAR):

$$\frac{\frac{260\ \text{DAYS}}{\text{YEAR}} \times \frac{300\ \text{AVG MEALS}}{\text{DAY}} \times \frac{2.4\ \text{GALLONS}}{\text{MEAL}} \times \frac{8.3\ \text{LBS.}}{\text{GALLON}} \times \frac{1\ \text{BTU}}{\text{LB}} \times 70}{1{,}000{,}000\ \text{BTU/MMBTU} \times 80\%\ \text{EFFICIENCY}} = \frac{136.0\ \text{MMBTU}}{\text{YEAR}}$$

ENERGY USAGE FOR DOMESTIC HOT WATER (ENTIRE YEAR)	240 MMbTU
EQUIVALENT NATURAL GAS CONSUMPTION (MCF/YR)	233 MCF

EXISTING DOMESTIC HOT WATER USAGE CALCULATION

EXERCISE AREA (ENTIRE YEAR):

$$\frac{\frac{260\ \text{DAYS}}{\text{YEAR}} \times \frac{10\ \text{GALLON}}{\text{PERSON}} \times \frac{40\ \text{PEOPLE}}{\text{DAY}} \times \frac{8.3\ \text{LBS.}}{\text{GALLON}} \times \frac{1\ \text{BTU}}{\text{LB}} \times 90}{1{,}000{,}000\ \text{BTU/MMBTU} \times 80\%\ \text{EFFICIENCY}} = \frac{97.1\ \text{MMBTU}}{\text{YEAR}}$$

GENERAL USAGE (ENTIRE YEAR):

$$\frac{\frac{260\ \text{DAYS}}{\text{YEAR}} \times \frac{0.5\ \text{GALLON}}{\text{PERSON}} \times \frac{300\ \text{PEOPLE}}{\text{DAY}} \times \frac{8.3\ \text{LBS.}}{\text{GALLON}} \times \frac{1\ \text{BTU}}{\text{LB}} \times 90}{1{,}000{,}000\ \text{BTU/MMBTU} \times 80\%\ \text{EFFICIENCY}} = \frac{36.4\ \text{MMBTU}}{\text{YEAR}}$$

FOOD SERVICE, FULL MEAL (ENTIRE YEAR):

$$\frac{\frac{260\ \text{DAYS}}{\text{YEAR}} \times \frac{300\ \text{AVG MEALS}}{\text{DAY}} \times \frac{2.4\ \text{GALLONS}}{\text{MEAL}} \times \frac{8.3\ \text{LBS.}}{\text{GALLON}} \times \frac{1\ \text{BTU}}{\text{LB}} \times 90}{1{,}000{,}000\ \text{BTU/MMBTU} \times 80\%\ \text{EFFICIENCY}} = \frac{174.8\ \text{MMBTU}}{\text{YEAR}}$$

ENERGY USAGE FOR DOMESTIC HOT WATER (ENTIRE YEAR)	308 MMbTU
EQUIVALENT NATURAL GAS CONSUMPTION (MCF/YR)	299 MCF

causing the sensor to transmit a false outdoor air temperature reading to the EMCS. Relocate the sensor to the outdoor which will allow the EMCS to function more efficiently with a more accurate outdoor air temperature reading.

7.2 Electric O&Ms

Currently 35 single lamp incandescent downlights are located throughout the main corridor and vestibule area. The luminaires utilize 50 watt PAR lamps and are basically operated during building occupied time periods. Annual energy cost for these luminaires is $282. Based on the light model, the annual usage and demand for these luminaires are as follows:

Description	*Typical Month*	*Non-Summer Quantities*	*Non-Summer Costs*	*Summer Quantities*	*Summer Costs*
Off-Peak kWh	38	266	$11	266	$9
Intermediate kWh	152	1,064	$49	1,064	$50
On-Peak kWh	228	1,596	$85	1,596	$99
Demand kW	2	12	$79	12	$203

Remove and replace the 50 watt PAR Lamps with 15 watt compact fluorescent lamps for use in downlights. The existing lamps could be replaced under standard operation and maintenance programs. The 15 watt compact fluorescent lamps will provide the same light output. Replacement will lower the annual energy cost for the down lights to $97 (((15 x 1.15) ÷ 50) x $282). Cost savings associated with this retrofit will be $185 ($282 - $97).

8.0 ECONOMIC ANALYSIS (LCCID)

8.1 General

The economic feasibility of each recommended and not recommended ECOs was studied on a life cycle basis, utilizing BLAST's LCCID program. LCCID calculates life cycle costs and additional economics for energy conservation opportunities in DoD construction. Using ECO data presented in Section 6, Entech calculated the economics of each ECO and presented these findings throughout this section.

8.2 General Inputs

LCCID requires general information to be entered. This information applies to each ECO evaluated and does not change throughout the calculations. The following table lists Entech's input to each general category.

Table 8.2.1, LCCID General Inputs

#	*Input*	
1	Type of Study	Military Construction Army (MCA)
2	Energy Consumption Values Entered	Yes
3	Is This a Non-ECIP Study	No
4	Economic Life of Building	25
5	Location of Study	District of Columbia
6	Energy Inputs	English
7	Electrical Prices, $/mmBtu	Vary Per ECO, Refer to Input Table
8	Gas Prices, $/mmBtu	$7.60
9	All Other Fuels, #/mmBtu	$0.00

8.3 Analysis Inputs

This section lists the inputs for the economic analysis shown in Section 8.5. Information on energy cost savings by fuel and construction costs for each ECO have been retrieved from Section 6 and summarized below. Tables 8.3.1 and 8.3.2 list the inputs which will be used for each ECO economic run.

Table 8.3.1, Recommended ECO Input Summary

ECO #	*Electric mmBtu*	*Electric $/mmBtu*	*Gas mmBtu*	*Gas $/mmBtu*	*Oil mmBtu*	*Oil $/mmBtu*	*Const. Cost*	*Maint. Savings*	*Design Cost*
1			1,740	$7.60			$8,000	$0	$1,000
2	2,919	$11.68	3,140	$7.60			$45,000	$0	$5,000
3	90	$20.10	1,259	$7.60			$14,000	$0	$0
4	244	$10.66					$6,000	$0	$1,000
4A	1,790	$11.06					$70,000	$0	$7,000
5	427	$26.70	(657)	$7.60			$22,000	$0	$3,000
6	199	$22.10					$15,000	$0	$1,000
7	175	$38.27	(218)	$7.60			$18,000	$0	$2,000
8	72	$16.66					$5,900	$0	$600
9	1,263	$27.48					$187,600	$0	$22,400
10	714	$27.45					$123,300	$0	$14,600
11	8	$12.00					$700	$110	$100
12	23	$29.81					$6,100	$0	$400
13	150	$14.96					$14,100	$1,000	$900
14	51	$15.61					$12,600	$0	$400

Table 8.3.2, Not Recommended ECO Input Summary

ECO #	*Electric mmBtu*	*Electric $/mmBtu*	*Gas mmBtu*	*Gas $/mmBtu*	*Oil mmBtu*	*Oil $/mmBtu*	*Const. Cost*	*Maint. Cost*	*Design Cost*
A	24	$16.63					$5,900	$0	$600
B	41	$26.93					$17,600	$0	$1,400
C	6	$12.55					$700	$110	$100
D	35	$11.43					$14,600	$0	$1,400
E	1,994	$11.78					$80,000	$0	$10,000
F	175	$8.02					$10,800	$0	$1,200
G	723	$12.31					$98,000	$0	$12,000
H	462	$39.49			(1,540)	$4.33	$130,000	$0	$15,000
I	0	$0.00					$260,000	$0	$30,000
J	0	$0.00	150	$7.60			$20,000	$0	$2,000
K	86	$111.62			(287)	$4.33	$130,000	$0	$15,000
L	0	$0.00					$450,000	$0	$50,000

8.4 Analysis Findings

The tables on the following page display the savings to investment ratio and return on investment for each ECO. Individual ECO analysis can be found in Attachment 10.5.

Table 8.4.1, Recommended ECO Output Summary, Not Prioritized

ECO #	*ECO Description*	*(SIR) Savings to Investment Ratio*	*Single Payback Years*
1	Reducing Boiler Cycling (Nov-Apr)	38.1	0.7
2	Expand Energy Monitoring and Control System	24.9	0.9
3	Shut off Boiler in Summer	20.1	1.2
4	Security Room AC Renovations	6.8	2.7
4A	Shut down Chiller During Winter and Summer Unoccupied Periods	4.7	3.9
5	Electric Cooking Equipment to Natural Gas	3.2	3.9
6	Reduce Building HVAC Outdoor Air Requirements	5.1	3.6
7	Replace Electric Dishwasher Booster Heater	4.0	4.0
8	100 Watt HPS Loading Dock Luminaires	3.4	5.4
9	4' T-8 Lamp Retrofit	3.0	6.1
10	Reflectors	2.6	7.0
11	3' HPS Bollards	4.6	4.0
12	Replace 75 Watt Mercury Vapor Wall Washers	1.9	9.3
13	Motion Sensors	2.9	6.3
14	Exit Signs to LED	2.5	7.2

Table 8.4.2, Not Recommended ECO Output Summary

ECO #	*ECO Description*	*(SIR) Savings to Investment Ratio*	*Simple Payback Years*
A	150 HPS Loading Dock Luminaires	1.1	16.3
B	2' and 3' T-8 Lamp Retrofit	1.1	17.3
C	3' MH Bollards	4.1	4.2
D	Exterior Lighting	0.5	4.0
E	Shut down Chiller During Winter and Summer Unoccupied Periods	4.8	3.8
F	Security Room	2.2	8.6
G	Variable Frequency Drive Controllers	1.3	12.4
H	Peak Shaving With Diesel Generators	1.5	12.4
I	Chilled Water Storage	0.6	28.2
J	Oxygen Trim Controls on Boilers	1.3	20.0
K	PEPCO's Curtailment Program	1.0	17.3
L	Electric Rate	1.9	9.0

9.0 CONCLUSION

A complete summary of the recommended ECOs is shown on the following page. If fully implemented, these measures would result in the following:

Construction Cost	$607,700
Energy Savings	$180,400
Maintenance Savings	$ 1,100
Simple Payback	3.4 YRS

9.1 Energy Savings

Table 9.1 below lists the total energy saved if the recommended ECOs are implemented. Table 9.1.1 summarizes both recommended and non-recommended ECOs, in a non-prioritized list. All ECOs are grouped and prioritized in Section 1.

Table 9.1, Energy Savings by Fuel Type

Description	*Quantity*
Electric Demand, kW/yr	3,347
Electric Usage, kWh/yr	2,383,734
Natural Gas, mcf/yr	5,110
Fuel Oil, gal/yr	0
Total Energy, mmBtu/yr	13,399

TABLE 9.1.1
RECOMMENDED ECO SUMMARY, NO INTERACTION

RECOMMENDED ECOs																			
		ELECTRICITY						NATURAL GAS			FUEL OIL			ANNUAL TOTALS					
ECO #	DESCRIPTION	Demand kW	Off-Peak kWh	Inter kWh	On-Peak kWh	Cost $	Btu/sf	Usage mcf	Cost $	Btu/sf	Usage gal	Cost $	Btu/sf	Btu/sf	Total Cost	Maint. Savings	Const. Cost	Payback Period	SIR
1	Reduce Boiler Cycling	0	0	0	0	$0	0	1,689	$13,300	7,146	0	$0	0	7,146	$13,300	$0	$9,000	0.7	38.1
2	Expand Energy Monitoring and Control System	0	709,942	130,528	14,895	$34,100	11,991	3,049	$23,900	12,900	0	$0	0	24,891	$58,000	$0	$50,000	0.9	24.9
3	Shut off Boiler in Summer	37	14,648	5,685	5,910	$1,800	368	1,222	$9,600	5,170	0	$0	0	5,538	$11,400	$0	$14,000	1.2	20.1
4	Security Room AC Renovation	(2)	60,319	11,358	(192)	$2,600	1,002	0	$0	0	0	$0	0	1,002	$2,600	$0	$7,000	2.7	6.8
4A	Shutdown Chiller During Winter & Summer Unoccupied Periods	67	417,523	72,900	34,070	$19,800	7,353	0	$0	0	0	$0	0	7,353	$19,800	$0	$77,000	3.9	4.7
5	Electric Cooking Equipment to Natural Gas	535	45,648	59,064	20,410	$11,400	1,754	(638)	($5,000)	(2,699)	0	$0	0	(945)	$6,400	$0	$25,000	3.9	3.2
6	Reduce Building HVAC Outdoor Air Requirements	105	29,952	13,551	14,895	$4,400	818	0	$0	0	0	$0	0	818	$4,400	$0	$16,000	3.6	5.1
7	Replace Electric Dishwasher Booster Heater	379	8,100	21,600	21,600	$6,700	719	(212)	($1,700)	(897)	0	$0	0	(178)	$5,000	$0	$20,000	4.0	4.0
8	100 Watt HPS Loading Dock Luminaires	31	11,052	5,023	5,023	$1,200	296	0	$0	0	0	$0	0	296	$1,200	$0	$6,500	5.4	3.4
9	4' T-8 Retrofit	1,442	38,018	133,215	198,697	$34,700	5,186	0	$0	0	0	$0	0	5,186	$34,700	$0	$210,000	6.1	3.0
10	Reflectors	722	21,602	75,375	112,218	$19,600	2,933	0	$0	0	0	$0	0	2,933	$19,600	$0	$137,900	7.0	2.6
11	3' HPS Bollards	0	1,416	541	241	$90	31	0	$0	0	0	$0	0	31	$90	$110	$800	4.0	4.6
12	Replace 75 Watt Mercury Vapor Wall Washers	31	626	2,507	3,748	$700	96	0	$0	0	0	$0	0	96	$700	$0	$6,500	9.3	1.9
13	Motion Sensors	0	4,394	17,044	25,572	$2,400	659	0	$0	0	0	$0	0	659	$2,400	$0	$15,000	6.3	2.9
14	Exit Signs to LED	0	7,860	3,578	3,578	$800	211	0	$0	0	0	$0	0	211	$800	$1,000	$13,000	7.2	2.5
	TOTAL RECOMMENDED ECO'S	3,347	1,371,100	551,969	460,665	$140,290	33,418	5,110	$40,100	21,620	0	$0	0	55,038	$180,400	$1,110	$607,700	3.4	

NON-RECOMMENDED ECO SUMMARY, NO INTERACTION

RECOMMENDED ECOs																			
		ELECTRICITY						NATURAL GAS			FUEL OIL			ANNUAL TOTALS					
ECO #	DESCRIPTION	Demand kW	Off-Peak kWh	Inter kWh	On-Peak kWh	Cost $	Btu/sf	Usage mcf	Cost $	Btu/sf	Usage gal	Cost $	Btu/sf	Btu/sf	Total Cost	Maint. Savings	Const. Cost	Payback Period	SIR
A	150 HPS Loading Dock Luminaires	10	3,684	1,675	1,675	$400	99	0	$0	0	0	$0	0	99	$400	$0	$6,500	16.3	1.1
B	2' and 3' T-8 Lamp Retrofit	48	0	4,787	7,182	$1,100	168	0	$0	0	0	$0	0	168	$1,100	$0	$19,000	17.3	1.1
C	3' MH Bollards	0	1,193	465	210	$80	26	0	$0	0	0	$0	0	26	$80	$110	$800	4.2	4.1
D	Exterior Lighting	0	6,656	2,477	1,084	$400	143	0	$0	0	0	$0	0	143	$400	$0	$16,000	40.0	0.5
E	Shutdown Chiller During Winter & Summer Unoccupied Periods	185	432,551	97,339	54,486	$23,500	8,193	0	$0	0	0	$0	0	8,193	$23,500	$0	$90,000	3.8	4.8
F	Security Room	(35)	50,556	6,124	(5,542)	$1,400	717	0	$0	0	0	$0	0	717	$1,400	$0	$12,000	8.6	2.2
G	Variable Frequency Drive Controllers	0	124,253	43,731	43,795	$8,900	2,969	0	$0	0	0	$0	0	2,969	$8,900	$0	$110,000	12.4	1.3
H	Peak Shaving with Diesel Generator	0	0	0	135,406	$16,400	1,898	0	$0	0	(11,107)	($4,700)	(6,327)	(4,429)	$11,700	$0	$145,000	12.4	1.5
I	Chilled Water Storage	(332)	(67,703)	(67,703)	135,406	$10,300	0	0	$0	0	0	$0	0	0	$10,300	$0	$290,000	28.2	0.6
J	Oxygen Trim Controls on Boilers	0	0	0	0	$0	0	146	$1,100	618	0	$0	0	618	$1,100	$0	$22,000	20.0	1.3
K	PEPCOs Curtailment Program	968	0	0	25,200	$9,600	353	0	$0	0	(2,067)	($1,200)	(1,178)	(824)	$8,400	$0	$145,000	17.3	1.0
L	Electric Rate "GT-3B"	0	0	0	0	$55,400	0	0	$0	0	0	$0	0	0	$55,400	$0	$500,000	9.0	1.9

With the ECO savings, the energy cost (dollars per square foot) will be reduced to the following levels:

Table 9.1.2, Dollars per Square Foot Changes

Description	*Before ECOs*	*After ECOs*
Electricity	$1.42	$0.84
Natural Gas	$0.41	$0.24
Fuel Oil	$0.00	$0.00
Total	$1.83	$1.08

Likewise, Btus per square foot will change as follows:

Table 9.1.3, Btus per Square Foot Changes

Description	*Before ECOs*	*After ECOs*
Electricity	71,228	37,809
Natural Gas	53,639	32,019
Fuel Oil	0	0
Total	124,867	69,828

9.2 Future Energy Costs

Energy conservation is becoming an increasingly important factor for the building manager. As energy prices increase, the incentive to conserve energy also increases.

One method of predicting future energy costs is to use an average fuel escalation rate. If an annual increase in energy costs is assumed to be 2%, the following cost would occur, assuming there would be no added loads.

Table 9.2.1, Estimated Future Energy Costs

Year	*Before ECOs*	*After ECOs*
1995	$444,600	$264,200
1996	$453,000	$269,000
1997	$462,000	$274,000
1998	$471,000	$279,000
1999	$480,000	$285,000
Totals	$2,310,600	$1,371,200
Savings		$939,400

Savings over a five year period would total $939,400 if all recommended ECOs are implemented.

ATTACHMENT 10.1
ELECTRIC RATE SCHEDULES

DC - GT

TIME METERED GENERAL SERVICE
SCHEDULE "GT"

AVAILABILITY - Shall be applicable in the District of Columbia portion of the Company's service area to customers whose maximum thirty (30) minute demand equals or exceeds one hundred (100) kilowatts during two (2) or more billing months within twelve (12) consecutive billing months. Once a customer's account is established it will remain on Schedule "GT" even if the party responsible for the account should change. Removal from Schedule "GT" is based solely on the criteria stated in the following paragraph.

Any customer presently on Schedule "GT" whose maximum thirty (30) minute demand is less than eighty (80) kilowatts for twelve (12) consecutive billing months, may at the customer's option elect to continue service on this schedule or elect to be served under any other available schedule. If the customer elects to stay on Schedule "GT", the customer will remain on Schedule "GT" for at least twelve (12) billing months.

This schedule will become active for eligible customers as soon as the three (3) month customer notification process is completed. New accounts may, however, elect to waive the customer notification process.

Available for low voltage electric service at sixty hertz.

Available for standby service when modified by Schedule "S".

Available for primary service when modified by Rider "GT-3A" or Rider "GT-3B".

Not available for temporary service.

Not available for multiple application to master-metered apartment buildings except for those master-metered apartments served under Schedule "GT" prior to December 31, 1982 which will continue to be served under Schedule "GT".

DC - GT

CHARACTER OF SERVICE -

SECONDARY SERVICE - The service supplied under this schedule normally will be alternating current, sixty hertz, either (i) single phase, three wire, 120/240 volts or 120/208 volts, or (ii) three phase, four wire, 120/208 volts or 265/460 volts.

PRIMARY AND HIGH VOLTAGE SERVICE - The service under this schedule when modified by Rider "GT-3A", normally will be alternating current, sixty hertz, three phase, three wire, at 4.16kV, 13.2kV or 33kV, and when modified by Rider "GT-3B", will be 66kV or above. Primary nominal service voltage levels will be specified by the Company on the basis of its available facilities and the magnitude of the load to be served.

MONTHLY RATE -

	Billing Months of June - October (Summer)		Billing Months of November - May (Winter)	
A. Customer Charge	$ 21.30	per month	$ 21.30	per month
B. Energy Charge				
On-Peak Period	5.714¢	per kwhr	4.727¢	per kwhr
Intermediate Period	4.163¢	per kwhr	4.082¢	per kwhr
Off-Peak Period	2.888¢	per kwhr	3.101¢	per kwhr
C. On-Peak Demand Charge	$ 10.65	per kw	-	
D. Maximum Demand Charge	$ 6.70	per kw	$ 6.70	per kw

E. Minimum Charge - The Customer Charge

DC - GT

RIDER "FA" - FUEL ADJUSTMENT CHARGE - The rates stated above include a base fuel cost component of 2.36398¢ per kilowatt-hour for secondary service and 2.29240¢ per kilowatt-hour for primary and high voltage service including adjustment for losses. Incremental charges for fuel and interchange, computed in accordance with the provisions of Fuel Adjustment Charge - Rider "FA", combined with monthly charges under the provisions of this schedule, constitute the total charge for the services which the Company furnishes.

RATING PERIODS -

Weekdays - (Excluding Holidays)

On-Peak Period	12:00 noon	to	8:00 p.m.
Intermediate Period	8:00 a.m.	to	12:00 noon
		and	
	8:00 p.m.	to	12:00 midnight
Off-Peak Period	12:00 midnight	to	8:00 a.m.

Saturdays, Sundays and Holidays

Off-Peak Period All Hours

Holidays

For the purpose of this tariff, holidays will be New Year's Day, Rev. Martin Luther King's Birthday, Presidents' Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans' Day, Thanksgiving Day, and Christmas Day, as designated by the Federal Government.

BILLING DEMANDS -

On-Peak (Summer Billing Months Only) - The billing demand shall be the maximum thirty (30) minute demand recorded during the on-peak period of the billing month.

Maximum (All Months) - The billing demand shall be the maximum thirty (30) minute demand recorded during the billing month.

RIDER "GT-1" - POWER FACTOR - This rider is applied to and is a part of Schedule "GT" if the customer is found to have a leading power factor or a lagging power factor of less than 85%. If power factor corrective equipment satisfactory to the Company has not been installed within ninety (90) days of notification by the Company, the demand charges will be multiplied by a factor of 1.111.

RIDER "GT-3A" - PRIMARY SERVICE - This rider is applied to and is a part of Schedule "GT" when the Company furnishes service directly from its electric system at voltages of 4.16kV, 13.2kV or 33kV, the customer providing at the customer's own expense, all necessary transformers, converting apparatus, switches, disconnectors, regulators and protective equipment. In such case the service will be measured at the primary voltage and a discount of 5% will be allowed on parts (A) through (E) of the Monthly Rate.

RIDER "GT-3B" - HIGH VOLTAGE SERVICE - This rider is applied to and is a part of Schedule "GT" when the Company furnishes service directly from its electric system at voltages of 66kV or above, the customer providing at the customer's expense, all necessary transformers, converting apparatus, switches, disconnectors, regulators and protective equipment. In such case the service will be measured at the high voltage and a discount of 21.05% will be allowed on parts (A) through (E) of the Monthly Rate.

RIDER "CS" - CURTAILABLE SERVICE - This rider is applied to and is a part of Schedule "GT" when a customer meets the criteria set forth in Curtailable Service - Rider "CS".

RIDER "CS-EX" - EXPERIMENTAL CURTAILABLE SERVICE - This rider is applied to and is a part of Schedule "GT" when a customer meets the criteria set forth in Experimental Curtailable Service - Rider "CS-EX".

RIDER "CLR" - COMMERCIAL LOAD REDUCTION SERVICE - This rider is applied to and becomes a part of Schedule "GT" when a customer meets the criteria set forth in Commercial Load Reduction Service - Rider "CLR".

RIDER "CAA" - CLEAN AIR ACT SURCHARGE - This rider is applied to and becomes part of Schedule "GT" to reflect Clean Air Act compliance costs.

METER READING - Watt-hour meters will be read to the nearest multiple of the meter constant and bills rendered accordingly.

GENERAL TERMS AND CONDITIONS - This schedule is subject in all respects to the Company's "General Terms and Conditions for Furnishing Electric Service" and the Company's "Electric Service Rules and Regulations".

ATTACHMENT 10.2
ELECTRIC UTILITY BILLS

pepco

637

Potomac Electric Power Company
P.O. Box 2812 Washington, DC 20067-2812
Telephone (202) 833-7500

(Pepco's Taxpayer Identification No. 53-0127880)

AMOUNT PAID
40,463 05

TYPE OF BILL Edited Reading

SERVICE ADDRESS 2ND & T ST SW

OCT 28 1993

Reminder Notice
Summer Rates In Effect

H
17

DEPARTMENT OF THE ARMY
C/O DZR OF ENGINEERING
ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211-5050

Due Nov 12, 1993	86925.40
Due After Nov 12	88029.30

Payment may be made payable to **pepco**

PLEASE WRITE THE ACCOUNT NO. ON YOUR REMITTANCE ▶

4010881741200469290000880293011129300869254000001088174 12

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

▶ 0108817412 17

SERVICE ADDRESS 2ND & T ST SW

TYPE OF BILL Edited Reading
Summer Rates In Effect
SERVICE PERIOD Sep 16 to Oct 15 1993 29 DAYS

METER NO. LAST DIGITS	MULTIPLIER	METER READING PREVIOUS	PRESENT	KWH USED KW DEMAND	DESCRIPTION	AMOUNT
9101	1200	4284	4284	0	Kilowatt Hour Meter	
9100	1200	5280	5684	484800	Kilowatt Hour Meter	
				214145	Off-Pk $.028219/KWH	6043.17
				127283	Interm $.040670/KWH	5176.60
				144114	On-Pk $.055964/KWH	8065.24
Total KWH Billed				485542	Non-Residential-GT 3A	
*Maximum Demand				1207.2	Distribution Charge	7846.80
*On-Peak Demand				1153.0	Production & Transm	11991.20

Discount	1956.15CR
Fuel Cost Adjustment at $.00317890 per KWH	1543.49
DC Gross Receipts Adjustment	1286.05
NET CURRENT BILL	39996.40
Prior Bill Amount	87067.01
Payments Through Oct 21	40604.66CR
Late Payment Charge	466.65
TOTAL BALANCE FORWARD	46929.00
Approved 10-7-93	- 46,462.35
PLEASE PAY THE AMOUNT NOW DUE	~~86925.40~~ $ 40,463.05

After Nov 12, 1993, a Late Payment Charge of $1103.90 will be added, increasing the amount due to $88029.30.

Just a reminder that a past due amount remained on your account at the time we prepared your bill.

The scheduled meter read date for your next bill is Nov 16, 1993.

pepco

12070

Potomac Electric Power Company
P.O. Box 2812 Washington, DC 20067-2812
Telephone (202) 833-7500

(Pepco's Taxpayer Identification No. 53-0127880)

AMOUNT PAID
$23,503 | 44

TYPE OF BILL: Actual Reading

SERVICE ADDRESS: 2ND & T ST SW

NOV 24 1993

Reminder Notice
Winter Rates In Effect

H
17

DEPARTMENT OF THE ARMY
C/O DZR OF ENGINEERING
ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211-5050

Due Dec 13, 1993	63966.49
Due After Dec 13	64810.50

Payment may be made payable to **pepco**

PLEASE WRITE THE ACCOUNT NO. ON YOUR REMITTANCE ▶

3010881741200408700100648105012139300639664900000108817412

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

▶ 0108817412 17

SERVICE ADDRESS: 2ND & T ST SW

TYPE OF BILL: Actual Reading
Winter Rates In Effect

SERVICE PERIOD: Oct 15 to Nov 15 1993 31 DAYS

METER BILLS LAST MONTH	MULTIPLIER	METER READING PREVIOUS	PRESENT	KWH USED KW DEMAND*	DESCRIPTION	AMOUNT
9101	1200	4284	4351	80400	Kilowatt Hour Meter	
9100	1200	5684	5967	339600	Kilowatt Hour Meter	
				188195	Off-Pk $.030319/KWH	5706.07
				106995	Interm $.039899/KWH	4269.10
				125341	On-Pk $.046355/KWH	5810.30
Total KWH Billed				420531	Non-Residential-GT 3A	
*Maximum Demand				1099.2	Distribution Charge	7144.80
*On-Peak Demand				1087.2	Production & Transm	.00

Discount	1146.52CR
Fuel Cost Adjustment at $.00135560 per KWH	570.07
DC Gross Receipts Adjustment	742.66
NET CURRENT BILL	23096.48
Prior Bill Amount	86925.40
Payments Through Nov 19	46462.35CR
Late Payment Charge	406.96
TOTAL BALANCE FORWARD	40870.01
Sept. 15 - Oct. 15 bill	- 40463.05
PLEASE PAY THE AMOUNT NOW DUE	~~63966.49~~ $23,503.44

After Dec 13, 1993, a Late Payment Charge of $844.01 will be added, increasing the amount due to $64810.50.

Just a reminder that a past due amount remained on your account at the time we prepared your bill.

The scheduled meter read date for your next bill is Dec 17, 1993.

Period	Days	KWH-Used	Avg KWH per Day	% Change
Nov 92	29	375343	12942.9	
Nov 93	31	420531	13565.5	4.8

pepco

Potomac Electric Power Company
P.O. Box 2812 Washington. DC 20067-2812
Telephone (202) 833-7500

AMOUNT PAID
20,215 | 72

11838

(Pepco's Taxpayer Identification No 53-0127880)

TYPE OF BILL: Actual Reading

Reminder Notice
Winter Rates In Effect

SERVICE ADDRESS: 2ND & T ST SW

H DEPARTMENT OF THE ARMY
15--- C/O DZR OF ENGINEERING
--- ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211-5050

Due Feb 14, 1994	40023.45
Due After Feb 14	40523.71

Payment may be made payable to **pepco**

PLEASE WRITE THE ACCOUNT NO. ON YOUR REMITTANCE ▶

10108817412002000581004052371021494004002345000010881741 2

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

▶ 0108817412 15

TYPE OF BILL: Actual Reading
Winter Rates In Effect

SERVICE ADDRESS: 2ND & T ST SW

SERVICE PERIOD: Dec 15 to Jan 18 1994 34 DAYS

METER NO. LAST DIGITS	MULTIPLIER	METER READING PREVIOUS	PRESENT	KWH USED KW DEMAND*	DESCRIPTION	AMOUNT
9101	1200	4507	4703	235200	Kilowatt Hour Meter	
9100	1200	6130	6278	177600	Kilowatt Hour Meter	
D 11	10	15230	35272	200420	Off-Pk $.030319/KWH	6076.73
D 08	10	10326	20181	98550	Interm $.039900/KWH	3932.15
D 05	10	12633	23933	113000	On-Pk $.046374/KWH	5240.27
	Total KWH Billed			411970	Non-Residential-GT 3A	
	*Maximum Demand			913.9	Distribution Charge	5940.35
	*On-Peak Demand			898.5	Production & Transm	.00

Discount	1059.47CF
Fuel Cost Adjustment at $.00183520- per KWH	756.05CF
DC Gross Receipts Adjustment	643.66
NET CURRENT BILL	20017.64
~~Prior Bill Amount~~ Approved	~~19807.73~~
Late Payment Charge	198.08
TOTAL BALANCE FORWARD	20005.81
PLEASE PAY THE AMOUNT NOW DUE	~~40023.45~~ 20,215.72

After Feb 14, 1994, a Late Payment Charge of $500.26 will be added, increasing the amount due to $40523.71.

Just a reminder that a past due amount remained on your account at the time we prepared your bill.

The scheduled meter read date for your next bill is Feb 15, 1994.

Period	Days	KWH-Used	Avg KWH per Day	% Change
Jan 93	34	429927	12644.9	
Jan 94	34	411970	12116.8	4.2-

Potomac Electric Power Company

pepco

P.O. Box 2812 Washington, DC 20067-2812
Telephone (202) 833-7500

AMOUNT PAID

569

(Pepco's Taxpayer Identification No. 53-0127880)

TYPE OF BILL Actual Reading Winter Rates In Effect

SERVICE ADDRESS 2ND & T ST SW

DEC 3 - 1993

H
15

DEPARTMENT OF THE ARMY
C/O DZR OF ENGINEERING
ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211-5050

Due Jan 10, 1994 19807.73
Due After Jan 10 20005.81

Payment may be made payable to **pepco**

PLEASE WRITE THE ACCOUNT NO. ON YOUR REMITTANCE ▶

3010881741200000000000020005810110940019807730000108817412

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

▶ 0108817412 15

TYPE OF BILL Actual Reading
Winter Rates In Effect

SERVICE ADDRESS 2ND & T ST SW

SERVICE PERIOD Nov 15 to Dec 15 1993 30 DAYS

METER NO. LAST DIGITS	MULTIPLIER	METER READINGS PREVIOUS	PRESENT	KWH USED KW DEMAND*	DESCRIPTION	AMOUNT
9101	1200	4351	4507	187200	Kilowatt Hour Meter	
9100	1200	5967	5967	0	Meter Exchange	
9100	1200	5967	6130	195600	Kilowatt Hour Meter	
KWH	1	88195	0	0	Meter Exchange	
D 11	10	0	15230	152300	Off-Pk $.030320/KWH	4617.74
KWH	1	6995	0	0	Meter Exchange	
D 08	10	0	10326	103260	Interm $.039899/KWH	4120.07
KWH	1	25341	0	0	Meter Exchange	
D 05	10	0	12633	126330	On-Pk $.046354/KWH	5855.98
	Total KWH Billed			381890	Non-Residential-GT 3A	
	*Maximum Demand			981.1	Distribution Charge	6377.15
	*On-Peak Demand			981.1	Production & Transm	.00

Discount 1048.54CR
Avg. Fuel Cost Adjustment at $.00196800- per KWH 751.57CR
DC Gross Receipts Adjustment 636.90
NET CURRENT BILL 19807.73

Prior Bill Amount 63966.49
Payments Through Dec 20 63966.49CR

PLEASE PAY THE AMOUNT NOW DUE 19807.73

After Jan 10, 1994, a Late Payment Charge of $198.08 will be added, increasing the amount due to $20005.81.

Pepco wants to reward you for getting rid of your old energy-guzzling appliances. Take advantage of Pepco's Appliance Pick-Up Program by calling 1-800-487-1010, to make an appointment for us to pick up an old refrigerator, freezer or window air conditioner in working condition. We'll give you a $35 check or credit your electric bill for each appliance up to six, (but no more than two of any type). Let us help you save energy and money. Call today!

SEE REVERSE SIDE FOR IMPORTANT INFORMATION *IF APPLICABLE

pepco

Potomac Electric Power Company
P.O. Box 2812 Washington, DC 20097-2812
Telephone (202) 833-7500
(Pepco's Taxpayer Identification No. 53-0127880)

AMOUNT PAID
20,568.69
~~#20,365.54~~
RH

12126

TYPE OF BILL: Actual Reading
SERVICE ADDRESS: 2ND & T ST SW

Reminder Notice
Winter Rates In Effect

H
15

DEPARTMENT OF THE ARMY
C/O DZR OF ENGINEERING
ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211-5050

Due Mar 11, 1994	40784.41
Due After Mar 11	41294.35

Payment may be made payable to pepco

PLEASE WRITE THE ACCOUNT NO. ON YOUR REMITTANCE ▶

1010881741200204188700412943503119400407844100001088174l2

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

ACCOUNT NO. ▶ 0108817412 15

TYPE OF BILL: Actual Reading
Winter Rates In Effect

SERVICE ADDRESS: 2ND & T ST SW

SERVICE PERIOD: Jan 18 to Feb 15 1994 28 DAY

METER NO. / LAST READ	MULTIPLIER	METER READING PREVIOUS	PRESENT	KWH USED / KW DEMAND	DESCRIPTION	AMOUNT
9101	1200	4703	4864	193200	Kilowatt Hour Meter	
9100	1200	6278	6427	178800	Kilowatt Hour Meter	
D 11	10	35272	51082	158100	Off-Pk $.030319/KWH	4793.59
D 08	10	20181	30459	102780	Interm $.039899/KWH	4100.92
D 05	10	23933	35156	112230	On-Pk $.046375/KWH	5204.70
Total KWH Billed				373110	Non-Residential-GT 3A	
*Maximum Demand				889.0	Distribution Charge	5778.50
*On-Peak Demand				889.0	Production & Transm	.00

Discount	993.89C
Fuel Cost Adjustment at $.00221620 per KWH	826.88
DC Gross Receipts Adjustment	654.84
NET CURRENT BILL	20365.54
Prior Bill Amount	40023.45
Payments Through Feb 18	19807.73C
Late Payment Charge	203.15
~~TOTAL BALANCE FORWARD~~	~~20418.87~~ 20,568.69
PLEASE PAY THE AMOUNT NOW DUE	~~40784.41~~ # ~~20,365.54~~

Pd. #20215.72
2-1-94

After Mar 11, 1994, a Late Payment Charge of $509.94 will be added, increasing the amount due to $41294.35.

Just a reminder that a past due amount remained on your account at the time we prepared your bill.

The scheduled meter read date for your next bill is Mar 17, 1994

Period	Days	KWH-Used	Avg KWH per Day	% Change
Feb 93	29	395325	13631.9	
Feb 94	28	373110	13325.4	2.2-

pepco

Potomac Electric Power Company
P.O. Box 2812 Washington DC 20067-2812
Telephone (202) 833-7500

AMOUNT PAID

12026

Actual Reading   Winter Rates In Effect

SERVICE ADDRESS 2ND & T ST SW

H   DEPARTMENT OF THE ARMY
15---   C/O DZR OF ENGINEERING
---   ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211-5050

Due Apr 13, 1994   21213.05
Due After Apr 13   21425.18

Payment may be made payable to pepco

PLEASE WRITE THE ACCOUNT NO. ON YOUR REMITTANCE ▶

4010881741200000000000214251804139400212130500001088174l2

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

▶ 0108817412 15

TYPE OF BILL: Actual Reading
Winter Rates In Effect

SERVICE ADDRESS 2ND & T ST SW

SERVICE PERIOD Feb 15 to Mar 17 1994 30

METER NO.	MULTIPLIER	METER READING PREVIOUS	METER READING PRESENT	KWH USED KW DEMAND*	DESCRIPTION	AMOUNT
9101	1200	4864	4979	138000	Kilowatt Hour Meter	
9100	1200	6427	6636	250800	Kilowatt Hour Meter	
D 11	10	51082	66896	158140	Off-Pk $.030338/KWH	4797.75
D 08	10	30459	40856	103970	Interm $.039924/KWH	4150.96
D 05	10	35156	47786	126300	On-Pk $.046383/KWH	5858.27
	Total KWH Billed			388410	Non-Residential-GT 3A	
	*Maximum Demand			958.1	Distribution Charge	6232.44
	*On-Peak Demand			958.1	Production & Transm	.00

Discount	1051.95C
Avg. Fuel Cost Adjustment at $.00139930 per KWH	543.50
DC Gross Receipts Adjustment	682.08
NET CURRENT BILL	21213.05
Prior Bill Amount	40784.41
Payments Through Mar 23	40784.41C
PLEASE PAY THE AMOUNT NOW DUE	21213.05

After Apr 13, 1994, a Late Payment Charge of $212.13 will be added, increasing the amount due to $21425.18.

Please excuse the typographical error in the enclosed issue of Lines regarding the Earned Income Credit. The form needed is a "Schedule EIC" not a "Schedule C" as printed.

The scheduled meter read date for your next bill is Apr 15, 1994

Period	Days	KWH-Used	Avg KWH per Day	% Change
Mar 93	30	409662	13655.4	
Mar 94	30	388410	12947.0	5.2-

pepco

Potomac Electric Power Company
P O Box 2812 Washington, DC 20067-2812
Telephone (202) 833-7500

AMOUNT PAID

12064

(Pepco's Taxpayer Identification No. 53-0127880)

TYPE OF BILL Actual Reading   Winter Rates In Effect

SERVICE ADDRESS 2ND & T ST SW

H --- DEPARTMENT OF THE ARMY
15 C/O DZR OF ENGINEERING
--- ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211

Due May 11, 1994 21151.46
Due After May 11 21364.04

Payment may be made payable to **pepco**

PLEASE WRITE THE ACCOUNT NO. ON YOUR REMITTANCE ▶

4010881741200002121300213640405119400211514600001088174l2

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

ACCOUNT NO. ▶ 0108817412 | 15

TYPE OF BILL Actual Reading
Winter Rates In Effect

SERVICE ADDRESS 2ND & T ST SW

SERVICE PERIOD Mar 17 to Apr 15 1994 29 DAYS

METER NO. LAST DIGITS	MULTI-PLIER	METER READING PREVIOUS	PRESENT	KWH USED KW DEMAND*	DESCRIPTION	AMOUNT
9101	1200	4979	5128	178800	Kilowatt Hour Meter	
9100	1200	6636	6790	184800	Kilowatt Hour Meter	
D 11	10	66896	80792	138960	Off-Pk $.030984/KWH	4305.65
D 08	10	40856	51162	103060	Interm $.040744/KWH	4199.16
C 05	10	47786	59916	121300	On-Pk $.047339/KWH	5742.30
	Total KWH Billed			363320	Non-Residential-GT 3A	
	*Maximum Demand			977.3	Distribution Charge	6499.05
	*On-Peak Demand			977.3	Production & Transm	.00

Discount	1035.41CR
Fuel Cost Adjustment at $.00152840 per KWH	555.30
DC Gross Receipts Adjustment	673.28
NET CURRENT BILL	20939.33
Prior Bill Amount	21213.05
Payments Through Apr 21	21213.05CR
Late Payment Charge	212.13
TOTAL BALANCE FORWARD	212.13
PLEASE PAY THE AMOUNT NOW DUE	21151.46

After May 11, 1994, a Late Payment Charge of $212.58 will be added, increasing the amount due to $21364.04.

Pepco Gatekeepers look out for the safety and well-being of senior customers. In the April issue of LINES, learn about the Gatekeeper program and how to participate. And, if you're a Pepco customer age 55 or more, find out how you can receive a free subscription to SENIORLINES, Pepco's special newsletter for senior citizens.

pepco Potomac Electric Power Company
P O Box 2512 Washington DC 20067-2512
Telephone (202) 833-7500
(Pepco's Taxpayer Identification No 53-0127880

AMOUNT

$ 22,944

11618

Actual Reading — Winter Rates In Effect

SERVICE ADDRESS 2ND & T ST SW

H DEPARTMENT OF THE ARMY
15 C/O DZR OF ENGINEERING
--- ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211

Due Jun 13, 1994 44095
Due After Jun 13 44643

Payment may be ma
payable to pepco

PLEASE WRITE THE ACCOUNT NO ON YOUR REMITTANCE ▶

101088174120021364040044643260613940044095480000108817412

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

▶ 0108817412 15

TYPE OF BILL: Actual Reading
Winter Rates In Effect
SERVICE ADDRESS: 2ND & T ST SW
SERVICE PERIOD: Apr 15 to May 16 1994

METER NO. LAST DIGITS	MULTI-PLIER	METER READING PREVIOUS	PRESENT	KWH USED KW DEMAND*	DESCRIPTION	AMOUNT
9101	1200	5128	5295	200400	Kilowatt Hour Meter	
9100	1200	6790	6947	188400	Kilowatt Hour Meter	
D 11	10	80792	96952	161600	Off-Pk $.031104/KWH	5026.
D 08	10	51162	61655	104930	Interm $.040864/KWH	4287.
D 05	10	59916	72243	123270	On-Pk $.047456/KWH	5849.
Total KWH Billed				389800	Non-Residential-GT 3A	
*Maximum Demand				996.4	Distribution Charge	6626.
*On-Peak Demand				996.4	Production & Transm	.

Discount	1085.
Fuel Cost Adjustment at $.00332260 per KWH	1295.
DC Gross Receipts Adjustment	730.
NET CURRENT BILL	22731.
Prior Bill Amount	~~21151.~~
Late Payment Charge	212.
TOTAL BALANCE FORWARD	21364.

Rd 5-11-94

PLEASE PAY THE AMOUNT NOW DUE ~~44095.~~
$ 22,944

After Jun 13, 1994, a Late Payment Charge of $547.78 will be added, increasing the amount due to $44643.26.

Summer rates (June - October) go into effect soon. Summer ra are greater because of the higher costs to produce electricit so energy conservation is even more important during the summ One way to save energy is to use high-efficiency light bulbs appliances. Please use your Save & Save Again coupons for energy-efficient lighting and water heater conservation produ Haven't received your coupons or want up to 10 additional coupons? Call (202) 457-SAVE.

pepco

11364

Potomac Electric Power Company

P.O. Box 2812 Washington, DC 20067-2812
Telephone (202) 833-7500
(Pepco's Taxpayer Identification No. 53-0127880)

AMOUNT PAID
35,677 | 48

TYPE OF BILL Actual Reading   Summer Rates In Effect

ICE ESS 2ND & T ST SW

H --- DEPARTMENT OF THE ARMY
15 C/O DZR OF ENGINEERING
--- ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211

Due Jul 12, 1994 35677.48
Due After Jul 12 36034.25

FY94

Payment may be made payable to **pepco**

PLEASE WRITE THE ACCOUNT NO. ON YOUR REMITTANCE ▶ ACCOUNT NO

401088174120000000000036034250712940035677480000108817412

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

ACCOUNT NO. ▶ 0108817412 15

TYPE OF BILL Actual Reading
Summer Rates In Effect

SERVICE ADDRESS 2ND & T ST SW

SERVICE PERIOD May 16 to Jun 14 1994 29 DAYS

METER NO. LAST DIGITS	MULTIPLIER	METER READING PREVIOUS	PRESENT	KWH USED KW DEMAND	DESCRIPTION	AMOUNT
9101	1200	5295	5475	216000	Kilowatt Hour Meter	
9100	1200	6947	7122	210000	Kilowatt Hour Meter	
D 11	10	96952	15466	185140	Off-Pk $.029046/KWH	5377.58
D 08	10	61655	72920	112650	Interm $.041761/KWH	4704.39
D	10	72243	85015	127720	On-Pk $.057388/KWH	7329.63
Total KWH Billed				425510	Non-Residential-GT 3A	
*Maximum Demand				1006.1	Distribution Charge	6705.66
*On-Peak Demand				1006.1	Production & Transm	10679.75

Discount 1734.22CR
Fuel Cost Adjustment at $.00317920 per KWH 1352.79
DC Gross Receipts Adjustment 1261.90
NET CURRENT BILL 35677.48

Prior Bill Amount 44095.48
Payments Through Jun 21 44095.48CR

PLEASE PAY THE AMOUNT NOW DUE 35677.48

After Jul 12, 1994, a Late Payment Charge of $356.77 will be added, increasing the amount due to $36034.25.

Consider installing a ceiling fan to help you save money and energy this summer. Read all about it in the June issue of LINES. And check out our tips on how you can prepare for possible power outages during the summer storm season.

The scheduled meter read date for your next bill is Jul 15, 1994

pepco

Potomac Electric Power Company
P.O. Box 2812 Washington, DC 20067-2812
Telephone (202) 833-7500
(Pepco's Taxpayer Identification No. 53-0127880)

AMOUNT PAID

11219

Actual Reading   Summer Rates In Effect

SERVICE ADDRESS 2ND & T ST SW

H DEPARTMENT OF THE ARMY
15 C/O DZR OF ENGINEERING
--- ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211

Due Aug 11, 1994 42706.24
Due After Aug 11 43133.30

Payment may be made payable to **pepco**

PLEASE WRITE THE ACCOUNT NO. ON YOUR REMITTANCE ▶

2010881741200000000000043133300811940042706240000108817412

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

▶ 0108817412 15

TYPE OF BILL: Actual Reading
Summer Rates In Effect
SERVICE PERIOD: Jun 14 to Jul 15 1994 31 DAYS

SERVICE ADDRESS: 2ND & T ST SW

METER NUMBER	MULTIPLIER	METER READING PREVIOUS	PRESENT	KWH USED KW DEMAND	DESCRIPTION	AMOUNT
9101	1200	5475	5687	254400	Kilowatt Hour Meter	
9100	1200	7122	7351	274800	Kilowatt Hour Meter	
D 11	10	15466	38645	231790	Off-Pk $.029195/KWH	6767.27
D 08	10	72920	86956	140360	Interm $.041945/KWH	5887.50
05	10	85015	700	156850	On-Pk $.057591/KWH	9033.22
Total KWH Billed				529000	Non-Residential-GT 3A	
*Maximum Demand				1153.9	Distribution Charge	7731.13
*On-Peak Demand				1153.9	Production & Transm	12289.04

Discount 2077.06CR
Fuel Cost Adjustment at $.00295770 per KWH 1564.63
DC Gross Receipts Adjustment 1510.51
NET CURRENT BILL 42706.24

Prior Bill Amount 35677.48
Payments Through Jul 21 35677.48CR

PLEASE PAY THE AMOUNT NOW DUE 42706.24

After Aug 11, 1994, a Late Payment Charge of $427.06 will be added, increasing the amount due to $43133.30.

Information from the American Red Cross states that if you are caught in a storm, rather than lying down, squat low to the ground, making yourself the smallest possible target for lightning.

The scheduled meter read date for your next bill is Aug 15, 1994.

Period	Days	KWH-Used	Avg KWH per Day	% Change
Jul 93	32	598428	18700.9	
Jul 94	31	529000	17064.5	8.8-

*IF APPLICABLE

pepco

Potomac Electric Power Company
P.O. Box 2812 Washington, DC 20067-2812
Telephone (202) 833-7500

(Pepco's Taxpayer Identification No. 53-0127880)

AMOUNT PAID

10585

TYPE OF BILL: Actual Reading   Summer Rates In Effect

SERVICE ADDRESS: 2ND & T ST SW

H
15

DEPARTMENT OF THE ARMY
C/O DZR OF ENGINEERING
ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211

Due Sep 12, 1994 40924.97
Due After Sep 12 41334.22

Payment may be made payable to **pepco**

PLEASE WRITE THE ACCOUNT NO. ON YOUR REMITTANCE ▶

80108817412000000000000413342209129400409249700001088174l2

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

▶ 0108817412 15

TYPE OF BILL: Actual Reading
Summer Rates In Effect

SERVICE ADDRESS: 2ND & T ST SW

SERVICE PERIOD: Jul 15 to Aug 16 1994 32 DAYS

METER NO. LAST DIGITS	MULTIPLIER	METER READING PREVIOUS	PRESENT	KWH USED KW DEMAND	DESCRIPTION	AMOUNT
9101	1200	5687	5875	225600	Kilowatt Hour Meter	
9100	1200	7351	7569	261600	Kilowatt Hour Meter	
D 11	10	38645	59326	206810	Off-Pk $.029195/KWH	6037.95
D [illegible]	10	86956	99809	128530	Interm $.041945/KWH	5391.27
D 05	10	700	15872	151720	On-Pk $.057596/KWH	8738.47
Total KWH Billed				487060	Non-Residential-GT 3A	
*Maximum Demand				1140.5	Distribution Charge	7641.35
*On-Peak Demand				1140.5	Production & Transm	12146.33

Discount	1990.09CR
Fuel Cost Adjustment at $.00310470 per KWH	1512.18
DC Gross Receipts Adjustment	1447.51
NET CURRENT BILL	40924.97
Prior Bill Amount	42706.24
Payments Through Aug 19	42706.24CR
PLEASE PAY THE AMOUNT NOW DUE	40924.97

After Sep 12, 1994, a Late Payment Charge of $409.25 will be added, increasing the amount due to $41334.22.

See the August issue of LINES to see how you can get The Clean Switch catalogue of 20 electric products that are good for the environment.

The scheduled meter read date for your next bill is Sep 14, 1994

Period	Days	KWH-Used	Avg KWH per Day	% Change
Aug 93	29	509742	17577.3	
Aug 94	32	487060	15220.6	13.4-

pepco

Potomac Electric Power Company
P.O. Box 2812 Washington DC 20067-2812
Telephone (202) 833-7500
(Pepco's Taxpayer Identification No 53-0127880)

10687

TYPE OF BILL: Actual Reading

Reminder Notice
Summer Rates In Effect

SERVICE ADDRESS: 2ND & T ST SW

$ 38,219.33

H DEPARTMENT OF THE ARMY
15 C/O DZR OF ENGINEERING
--- ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211

Due Oct 11, 1994 ~~79144.30~~
Due After Oct 11 ~~80142.41~~

Payment may be made payable to pepco

PLEASE WRITE THE ACCOUNT NO. ON YOUR REMITTANCE ▶ ACCOUNT NO

1010881741200413342200801424110119400791443000001088174412

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

ACCOUNT NO. ▶ 0108817412 15

TYPE OF BILL: Actual Reading
Summer Rates In Effect

SERVICE ADDRESS: 2ND & T ST SW

SERVICE PERIOD: Aug 16 to Sep 14 1994 29 DAY

METER NO. LAST DIGITS	MULTIPLIER	METER READING PREVIOUS	PRESENT	KWH USED KW DEMAND*	DESCRIPTION	AMOUNT
9101	1200	5875	6042	200400	Kilowatt Hour Meter	
9100	1200	7569	7756	224400	Kilowatt Hour Meter	
D 11	10	59326	77776	184500	Off-Pk $.029243/KWH	5395.35
D 08	10	99809	11003	111940	Interm $.041993/KWH	4700.70
D 05	10	15872	28683	128110	On-Pk $.057669/KWH	7388.02
	Total KWH Billed			424550	Non-Residential-GT 3A	
	*Maximum Demand			1065.6	Distribution Charge	7139.52
	*On-Peak Demand			1065.6	Production & Transm	11348.64

Discount	1790.90-
Fuel Cost Adjustment at $.00539730 per KWH	2291.42
DC Gross Receipts Adjustment	1337.33
NET CURRENT BILL	37810.08
Paid 9-6-94 Prior ~~Bill Amount~~	~~40924.97~~
Late Payment Charge	409.25
TOTAL BALANCE FORWARD	~~41334.22~~
PLEASE PAY THE AMOUNT NOW DUE	~~79144.30~~ 38,219.33

After Oct 11, 1994, a Late Payment Charge of $998.11 will be added, increasing the amount due to $80142.41.

Just a reminder that a past due amount remained on your account at the time we prepared your bill.

11,00
Ar

The scheduled meter read date for your next bill is Oct 14, 199

SEE REVERSE SIDE FOR IMPORTANT INFORMATION *IF APPLICABLE

ATTACHMENT 10.3
INCREMENTAL COST CALCULATION

Potomac Electric Power Company, GT (Time Metered General Service) Electric Rate Analysis

Prepared by Entech Engineering, Inc.

Billing and Client Information

Client	Marshall Hall
Billing Year	1994
Billing Period	September
# of Billing Days	29
Enter "1" for Nov-May, 0 for Jun-Oct	0
Rates Schedule in Effect	Summer

Demand and Usage Information

Supply Voltage	13,200
Demand Measurements	
On-Peak Demand (kW)	1,066
Maximum Demand (kW)	1,066
Usage Measurements	
On-Peak Period (kWh)	128,110
Intermediate Period (kWh)	111,940
Off-Peak Period (kWh)	184,500
Registered Power Factor	100.00%

Taxes and Special Adjustments

Fuel Adjustments Rate	$0.0053973
DC Gross Receipts Adjustment	3.67%
Clean Air Act Surcharge	
Charge to On-Peak $/kWh	$0.0575031
Charge to Intermediate $/kWh	$0.0419930
Charge to Off-Peak $/kWh	$0.0292431

Potomac Electric Power Company, GT (Time Metered General Service) Electric Rate Analysis

Prepared by Entech Engineering, Inc.

Duplicated Electric Bill

Customer Charge	1	Bill @	$21.30	Per Bill =	$21.30
On-Peak Usage Charge					
Base Rate Charge	128,110	kWh @	$0.05714000	Per kWh =	$7,320.21
Clean Air Act Charge	128,110	kWh @	$0.00036308	Per kWh =	$46.51
Intermediate Usage Charge					
Base Rate Charge	111,940	kWh @	$0.04163000	Per kWh =	$4,660.06
Clean Air Act Charge	111,940	kWh @	$0.00036303	Per kWh =	$40.64
Off-Peak Usage Charge					
Base Rate Charge	184,500	kWh @	$0.02888000	Per kWh =	$5,328.36
Clean Air Act Charge	184,500	kWh @	$0.00036309	Per kWh =	$66.99
Demand Charges					
Maximum Demand Charge	1,066	kW @	$6.70	Per kW =	$7,139.52
On-Peak Demand Charge	1,066	kW @	$10.65	Per kW =	$11,348.64
Curtailment Credit	0	kW			$0.00
Curtailment Penalty	0	kW			$0.00
Voltage Discount	5.00	% x	$35,818.09	Subtotal =	($1,790.90)
Fuel Adjustment	$0.0053973	$/kWh x	424,550	Subtotal =	$2,291.42
DC Gross Receipts Adjust.	3.67	% x	$36,472.75	Subtotal =	$1,337.34
			CURRENT PERIOD CHARGES.		$37,810.08

Calculated Incremental

Incremental Cost Per kW	$17.09
Incremental Cost Per On-Peak kWh	$0.06224
Incremental Cost Per Intermediate kWh	$0.04697
Incremental Cost Per Off-Peak kWh	$0.03441

Calculated Billing Statistics Based on Incremental Costs

Demand Cost	$18,207.76	Energy Cost	$19,581.35
% Demand	48.2%	% Energy	51.8%
Load Factor	57.2%	Power Factor Penalty	$0.00

Current Electric Tariff (Rate HT)

	Summer	Winter
Customer Charge ($/Bill)	$21.30	$21.30
On-Peak Demand Charge ($/kW)	$10.65	$0.00
Maximum Demand Charge ($/kW)	$6.7000	$6.7000
On-Peak Usage Charge ($/kWh)	$0.057140	$0.047270
Intermediate Usage Charge ($/kWh)	$0.041630	$0.040820
Off-Peak Usage Charge ($/kWh)	$0.028880	$0.031010
Clean Air Act On-Peak Usage Charge, (Added $/kWh)	$0.000363	$0.000363
Clean Air Act Intermediate Usage Charge, (Added $/kWh)	$0.000363	$0.000363
Clean Air Act Off-Peak Usage Charge, (Added $/kWh)	$0.000363	$0.000363
Effective Power Factor (All kW)	85%	85%

Potomac Electric Power Company, GT (Time Metered General Service) Electric Rate Analysis

Prepared by Entech Engineering, Inc.

Electric Bill Calculation

Calculation Description	Actual Billing	Demand, kW Minus 1 kW	On-Peak Usage Minus 1 kWh	Intermediate Minus 1 kWh	Off-Peak Minus 1 kWh	100% Power Factor
On-Peak Demand (kW)	1,066	1,065	1,066	1,066	1,066	1,066
Maximum Demand (kW)	1,066	1,065	1,066	1,066	1,066	1,066
On-Peak Usage (kWh)	128,110	128,110	128,109	128,110	128,110	128,110
Intermediate Usage (kWh)	111,940	111,940	111,940	111,939	111,940	111,940
Off-Peak Usage (kWh)	184,500	184,500	184,500	184,500	184,499	184,500
Total Usage (kWh)	424,550	424,550	424,549	424,549	424,549	424,550
Fuel Adjustment Rate ($/kWh)	$0.0053973	$0.0053973	$0.0053973	$0.0053973	$0.0053973	$0.0053973
DC Gross Receipts Adjustment	3.67%	3.67%	3.67%	3.67%	3.67%	3.67%
Clean Air Act Added $/kWh, On-Peak kWh	$0.0003631	$0.000363	$0.000363	$0.000363	$0.000363	$0.000363
Clean Air Act Added $/kWh, Intermediate k	$0.0003630	$0.000363	$0.000363	$0.000363	$0.000363	$0.000363
Clean Air Act Added $/kWh, Off-Peak kWh	$0.0003631	$0.000363	$0.000363	$0.000363	$0.000363	$0.000363
Registered Power Factor	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Breakdown Calculations						
Power Factor Adjustment, 85%, On-Peak kW	0	0	0	0	0	0
Power Factor Adjustment, 85%, Maximum k	0	0	0	0	0	0
Billing On-Peak Demand (kW)	1,066	1,065	1,066	1,066	1,066	1,066
Billing Maximum Demand (kW)	1,066	1,065	1,066	1,066	1,066	1,066
On-Peak Usage (kWh)	128,110	128,110	128,109	128,110	128,110	128,110
Intermediate Usage (kWh)	111,940	111,940	111,940	111,939	111,940	111,940
Off-Peak Usage (kWh)	184,500	184,500	184,500	184,500	184,499	184,500
Cost Calculation						
Customer Charge, $	$21.30	$21.30	$21.30	$21.30	$21.30	$21.30
Off-Peak kWh Base Rate Charge, $	$5,328.36	$5,328.36	$5,328.36	$5,328.36	$5,328.33	$5,328.36
Intermediate kWh Base Rate Charge, $	$4,660.06	$4,660.06	$4,660.06	$4,660.02	$4,660.06	$4,660.06
On-Peak kWh Base Rate Charge, $	$7,320.21	$7,320.21	$7,320.15	$7,320.21	$7,320.21	$7,320.21
Clean Air Act Off-Peak Charge, $	$66.99	$66.99	$66.99	$66.99	$66.99	$66.99
Clean Air Act Intermediate Charge, $	$40.64	$40.64	$40.64	$40.64	$40.64	$40.64
Clean Air Act On-Peak Charge, $	$46.51	$46.51	$46.51	$46.51	$46.51	$46.51
On-Peak Demand Charge, $	$11,348.64	$11,337.99	$11,348.64	$11,348.64	$11,348.64	$11,348.64
Maximum Demand Charge, $	$7,139.52	$7,132.82	$7,139.52	$7,139.52	$7,139.52	$7,139.52
Subtotal, $ (Without Clean Air Act)	$35,818.09	$35,800.74	$35,818.03	$35,818.05	$35,818.06	$35,818.09
Subtotal, $ (With Clean Air Act)	$35,972.23	$35,954.88	$35,972.17	$35,972.19	$35,972.20	$35,972.23
Voltage Discount	($1,790.90)	($1,790.04)	($1,790.90)	($1,790.90)	($1,790.90)	($1,790.90)
Fuel Cost Adjustment	$2,291.42	$2,291.42	$2,291.42	$2,291.42	$2,291.42	$2,291.42
Subtotal (With Clean Air Act)	$36,472.75	$36,456.27	$36,472.69	$36,472.70	$36,472.72	$36,472.75
Subtotal (Without Clean Air Act)	$36,318.61	$36,302.12	$36,318.55	$36,318.56	$36,318.57	$36,318.61
DC Gross Receipts Adjustment	$1,337.34	$1,336.73	$1,337.33	$1,337.33	$1,337.33	$1,337.34
Net Current Bill	$37,810.08	$37,793.00	$37,810.02	$37,810.04	$37,810.05	$37,810.08
Incremental/Penalties	n/a	$17.09	$0.06224	$0.04697	$0.03441	$0.00000

Potomac Electric Power Company, GT (Time Metered General Service) Electric Rate Analysis

Prepared by Entech Engineering, Inc.

Incremental Cost Check

$ Calculations on Incrementals				
Demand ($)	1,066 kW x	$17.09 /kW =	$18,207.76
Off-Peak Usage ($)	184,500 kWh	$0.034 /kW =	$6,349.31
Intermediate Usage ($	111,940 kWh	$0.047 /kW =	$5,257.84
On-Peak Usage ($)	128,110 kWh	$0.062 /kW =	$7,974.20
		Total Calculated Billing Using Incrementals	**$37,789.11**
		Actual Current Period Charges	**$37,810.08**
		Cost Variance (Actual Minus Incremental)	**$20.98**
		Percent Variance (Var/Actual)	**0.1%**

0.0
0.0
0.0

pepco

Potomac Electric Power Company
P O Box 2812 Washington DC 20067-2812
Telephone (202) 833-7500
(Pepco's Taxpayer Identification No. 53-0127880)

AMOUNT PAID

10687

TYPE OF BILL Actual Reading

Reminder Notice
Summer Rates In Effect

SERVICE ADDRESS 2ND & T ST SW

$ 38,219.33

H DEPARTMENT OF THE ARMY
15 C/O DZR OF ENGINEERING
--- ANPW-OP BLDG 203 FT MYER
ARLINGTON VA 22211

Due Oct 11, 1994 ~~79144.30~~
Due After Oct 11 ~~80142.41~~

Payment may be made payable to **pepco**

PLEASE WRITE THE ACCOUNT NO. ON YOUR REMITTANCE ▶ ACCOUNT NO

1010881741200413342200801424110119400791443000001088174120

PLEASE DETACH HERE AND RETURN THIS PART WITH YOUR PAYMENT

ACCOUNT NO. ▶ 0108817412 15

TYPE OF BILL Actual Reading
Summer Rates In Effect

SERVICE ADDRESS 2ND & T ST SW

SERVICE PERIOD Aug 16 to Sep 14 1994 29 DAY

METER NO. LAST DIGITS	MULTIPLIER	METER READING PREVIOUS	METER READING PRESENT	KWH USED KW DEMAND*	DESCRIPTION	AMOUNT
9101	1200	5875	6042	200400	Kilowatt Hour Meter	
9100	1200	7569	7756	224400	Kilowatt Hour Meter	
D 11	10	59326	77776	184500	Off-Pk $.029243/KWH	5395.35
D 08	10	99809	11003	111940	Interm $.041993/KWH	4700.70
D 05	10	15872	28683	128110	On-Pk $.057669/KWH	7388.02
	Total KWH Billed			424550	Non-Residential-GT 3A	
	*Maximum Demand			1065.6	Distribution Charge	7139.52
	*On-Peak Demand			1065.6	Production & Transm	11348.64

Discount 1790.90

Fuel Cost Adjustment at $.00539730 per KWH 2291.42

DC Gross Receipts Adjustment 1337.33

NET CURRENT BILL 37810.08

Paid 9-6-94 Prior ~~Bill Amount~~ ~~40924.97~~

Late Payment Charge 409.25

TOTAL BALANCE FORWARD ~~41334.22~~

PLEASE PAY THE AMOUNT NOW DUE ~~79144.30~~ 38,219.33

After Oct 11, 1994, a Late Payment Charge of $998.11 will be added, increasing the amount due to $80142.41.

Just a reminder that a past due amount remained on your account at the time we prepared your bill.

1100
Ar

The scheduled meter read date for your next bill is Oct 14, 199

SEE REVERSE SIDE FOR IMPORTANT INFORMATION *IF APPLICABLE

Potomac Electric Power Company, GT (Time Metered General Service) Electric Rate Analysis

Prepared by Entech Engineering, Inc.

Billing and Client Information

Client	Marshall Hall
Billing Year	1994
Billing Period	December
# of Billing Days	29
Enter "1" for Nov-May, 0 for Jun-Oct	1
Rates Schedule in Effect	Winter

Demand and Usage Information

Supply Voltage	13,200
Demand Measurements	
On-Peak Demand (kW)	1,066
Maximum Demand (kW)	1,066
Usage Measurements	
On-Peak Period (kWh)	128,110
Intermediate Period (kWh)	111,940
Off-Peak Period (kWh)	184,500
Registered Power Factor	100.00%

Taxes and Special Adjustments

Fuel Adjustments Rate	$0.0053973
DC Gross Receipts Adjustment	3.67%
Clean Air Act Surcharge	
Charge to On-Peak $/kWh	$0.0476331
Charge to Intermediate $/kWh	$0.0411830
Charge to Off-Peak $/kWh	$0.0313731

Potomac Electric Power Company, GT (Time Metered General Service) Electric Rate Analysis

Prepared by Entech Engineering, Inc.

Duplicated Electric Bill

Customer Charge	1	Bill @	$21.30	Per Bill =	$21.30
On-Peak Usage Charge					
Base Rate Charge	128,110	kWh @	$0.04727000	Per kWh =	$6,055.76
Clean Air Act Charge	128,110	kWh @	$0.00036308	Per kWh =	$46.51
Intermediate Usage Charge					
Base Rate Charge	111,940	kWh @	$0.04082000	Per kWh =	$4,569.39
Clean Air Act Charge	111,940	kWh @	$0.00036303	Per kWh =	$40.64
Off-Peak Usage Charge					
Base Rate Charge	184,500	kWh @	$0.03101000	Per kWh =	$5,721.35
Clean Air Act Charge	184,500	kWh @	$0.00036309	Per kWh =	$66.99
Demand Charges					
Maximum Demand Charge	1,066	kW @	$6.70	Per kW =	$7,139.52
On-Peak Demand Charge	0	kW @	$10.65	Per kW =	$0.00
Curtailment Credit	0	kW			$0.00
Curtailment Penalty	0	kW			$0.00
Voltage Discount	5.00	% x	$23,507.32	Subtotal =	($1,175.37)
Fuel Adjustment	$0.0053973	$/kWh x	424,550	Subtotal =	$2,291.42
DC Gross Receipts Adjust.	3.67	% x	$24,777.52	Subtotal =	$908.51
				CURRENT PERIOD CHARGES.	$25,686.03

Calculated Incremental

Incremental Cost Per kW	$6.60
Incremental Cost Per On-Peak kWh	$0.05252
Incremental Cost Per Intermediate kWh	$0.04617
Incremental Cost Per Off-Peak kWh	$0.03651

Calculated Billing Statistics Based on Incremental Costs

Demand Cost	$7,031.24	Energy Cost	$18,633.81
% Demand	27.4%	% Energy	72.5%
Load Factor	57.2%	Power Factor Penalty	$0.00

Current Electric Tariff (Rate HT)

	Summer	Winter
Customer Charge ($/Bill)	$21.30	$21.30
On-Peak Demand Charge ($/kW)	$10.65	$0.00
Maximum Demand Charge ($/kW)	$6.7000	$6.7000
On-Peak Usage Charge ($/kWh)	$0.057140	$0.047270
Intermediate Usage Charge ($/kWh)	$0.041630	$0.040820
Off-Peak Usage Charge ($/kWh)	$0.028880	$0.031010
Clean Air Act On-Peak Usage Charge, (Added $/kWh)	$0.000363	$0.000363
Clean Air Act Intermediate Usage Charge, (Added $/kWh)	$0.000363	$0.000363
Clean Air Act Off-Peak Usage Charge, (Added $/kWh)	$0.000363	$0.000363
Effective Power Factor (All kW)	85%	85%

Potomac Electric Power Company, GT (Time Metered General Service) Electric Rate Analysis

Prepared by Entech Engineering, Inc.

Electric Bill Calculation

Calculation Description	Actual Billing	Demand, kW Minus 1 kW	On-Peak Usage Minus 1 kWh	Intermediate Minus 1 kWh	Off-Peak Minus 1 kWh	100% Power Factor
On-Peak Demand (kW)	1,066	1,065	1,066	1,066	1,066	1,066
Maximum Demand (kW)	1,066	1,065	1,066	1,066	1,066	1,066
On-Peak Usage (kWh)	128,110	128,110	128,109	128,110	128,110	128,110
Intermediate Usage (kWh)	111,940	111,940	111,940	111,939	111,940	111,940
Off-Peak Usage (kWh)	184,500	184,500	184,500	184,500	184,499	184,500
Total Usage (kWh)	424,550	424,550	424,549	424,549	424,549	424,550
Fuel Adjustment Rate ($/kWh)	$0.0053973	$0.0053973	$0.0053973	$0.0053973	$0.0053973	$0.0053973
DC Gross Receipts Adjustment	3.67%	3.67%	3.67%	3.67%	3.67%	3.67%
Clean Air Act Added $/kWh, On-Peak kWh	$0.0003631	$0.000363	$0.000363	$0.000363	$0.000363	$0.000363
Clean Air Act Added $/kWh, Intermediate k	$0.0003630	$0.000363	$0.000363	$0.000363	$0.000363	$0.000363
Clean Air Act Added $/kWh, Off-Peak kWh	$0.0003631	$0.000363	$0.000363	$0.000363	$0.000363	$0.000363
Registered Power Factor	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Breakdown Calculations						
Power Factor Adjustment, 85%, On-Peak kW	0	0	0	0	0	0
Power Factor Adjustment, 85%, Maximum k	0	0	0	0	0	0
Billing On-Peak Demand (kW)	1,066	1,065	1,066	1,066	1,066	1,066
Billing Maximum Demand (kW)	1,066	1,065	1,066	1,066	1,066	1,066
On-Peak Usage (kWh)	128,110	128,110	128,109	128,110	128,110	128,110
Intermediate Usage (kWh)	111,940	111,940	111,940	111,939	111,940	111,940
Off-Peak Usage (kWh)	184,500	184,500	184,500	184,500	184,499	184,500
Cost Calculation						
Customer Charge, $	$21.30	$21.30	$21.30	$21.30	$21.30	$21.30
Off-Peak kWh Base Rate Charge, $	$5,721.35	$5,721.35	$5,721.35	$5,721.35	$5,721.31	$5,721.35
Intermediate kWh Base Rate Charge, $	$4,569.39	$4,569.39	$4,569.39	$4,569.35	$4,569.39	$4,569.39
On-Peak kWh Base Rate Charge, $	$6,055.76	$6,055.76	$6,055.71	$6,055.76	$6,055.76	$6,055.76
Clean Air Act Off-Peak Charge, $	$66.99	$66.99	$66.99	$66.99	$66.99	$66.99
Clean Air Act Intermediate Charge, $	$40.64	$40.64	$40.64	$40.64	$40.64	$40.64
Clean Air Act On-Peak Charge, $	$46.51	$46.51	$46.51	$46.51	$46.51	$46.51
On-Peak Demand Charge, $	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Maximum Demand Charge, $	$7,139.52	$7,132.82	$7,139.52	$7,139.52	$7,139.52	$7,139.52
Subtotal, $ (Without Clean Air Act)	$23,507.32	$23,500.62	$23,507.27	$23,507.27	$23,507.28	$23,507.32
Subtotal, $ (With Clean Air Act)	$23,661.46	$23,654.76	$23,661.41	$23,661.42	$23,661.43	$23,661.46
Voltage Discount	($1,175.37)	($1,175.03)	($1,175.36)	($1,175.36)	($1,175.36)	($1,175.37)
Fuel Cost Adjustment	$2,291.42	$2,291.42	$2,291.42	$2,291.42	$2,291.42	$2,291.42
Subtotal (With Clean Air Act)	$24,777.52	$24,771.15	$24,777.47	$24,777.47	$24,777.48	$24,777.52
Subtotal (Without Clean Air Act)	$24,623.37	$24,617.01	$24,623.32	$24,623.33	$24,623.34	$24,623.37
DC Gross Receipts Adjustment	$908.51	$908.28	$908.51	$908.51	$908.51	$908.51
Net Current Bill	$25,686.03	$25,679.43	$25,685.97	$25,685.98	$25,685.99	$25,686.03
Incremental/Penalties	n/a	$6.60	$0.05252	$0.04617	$0.03651	$0.00000

Potomac Electric Power Company, GT (Time Metered General Service) Electric Rate Analysis

Prepared by Entech Engineering, Inc.

Incremental Cost Check

$ Calculations on Incrementals			
Demand ($)	1,066 kW x	$6.60 /kW =	$7,031.24
Off-Peak Usage ($)	184,500 kWh	$0.037 /kW =	$6,736.33
Intermediate Usage ($	111,940 kWh	$0.046 /kW =	$5,168.54
On-Peak Usage ($)	128,110 kWh	$0.053 /kW =	$6,728.94
		Total Calculated Billing Using Incrementals	**$25,665.05**
		Actual Current Period Charges	**$25,686.03**
		Cost Variance (Actual Minus Incremental)	**$20.98**
		Percent Variance (Var/Actual)	**0.1%**

0.0
0.0
0.0

ATTACHMENT 10.4
NATURAL GAS BILLS

If you wish to contribute to the Washington Area Fuel Fund, check the box and indicate amount. If you have previously pledged an amount, do not check box.

	Fuel Fund Donation	$
	Gas Bill Payment	$
	Total Payment	$

Washington Gas
District of Columbia Division

Telephone (703) 750-1000

Please Give Account Number

ACCOUNT NUMBER: 0002.577112 *01

DIR OF PUB WRKS
ANPW-OP
BLDG 203, FT MEYER
ARL VA 22211

NOV 15 1993

BILLS ARE DUE WHEN RENDERED.

AMOUNT DUE NOW	$ 7,721.13
AMOUNT DUE AFTER DATE BELOW	$ 7,798.34
OVERDUE AFTER	NOV 29, 93 G

0002577112077983407721130

PLEASE DETACH THIS STUB AND RETURN WITH PAYMENT • MAKE CHECK PAYABLE TO WASHINGTON GAS.

ACCOUNT NUMBER	BILLING PERIOD	DAYS USED	DATE MAILED	NEXT METER READING DATE
0002.577112	SEP 30, 93 OCT 29, 93	29	NOV 5, 93	DEC 1, 93

CURRENT READING METHOD	CURRENT READING	− PREVIOUS READING	+ UNMETERED GAS LIGHT	− CCF OF GAS USED	X THERMS PER CCF	= TOTAL THERMS
READ BY COMPANY	0994257	0984229		10,028	1.022	10,248.6

CHARGES FOR GAS SERVICE AT: 400 P ST SW *LIBR

CURRENT GAS USAGE - 10,248.6 THERMS @ $ .7972	$8,170.32
CUSTOMER CHARGE NON RES HEATING/COOLING LEVEL 2	26.18
PURCHASED GAS ADJUSTMENT @ $-.0191 PER THERM	195.75CR
INTERRUPTIBLE SALES CREDIT @ $-.0449 PER THERM	460.16CR
INCREASE IN DC GROSS RECEIPTS TAX	180.54

A PAYMENT OF $5,298.98 WAS RECEIVED ON 10/06/93.
A PAYMENT OF $5,600.86 WAS RECEIVED ON 11/04/93.

CURRENT BILL HAS BEEN PRORATED. NEW RATES EFFECTIVE 10/19/93: COMMODITY RATE $.7790 PER THERM, CUSTOMER CHARGE $27.10 PER MO.

BUDGET PLAN INFORMATION				
GAS USED THIS PERIOD	TOTAL GAS USED TO DATE	INSTALLMENTS BILLED TO DATE	AMOUNT DUE NOW	$ 7,721.13
$	$	$	AMOUNT DUE AFTER NOV 29, 93	$ 7,798.34

Washington Gas
District of Columbia Division

FOR YOUR RECORDS

CHECK NO. ____________ DATE: ____________

AMOUNT OF CHECK $ ____________

TAX DEDUCTIBLE WAFF CONTRIBUTION $ ____________

ACCOUNT NUMBER 0002.577112 *01

If you wish to contribute to the Washington Area Fuel Fund, check the box and indicate amount. If you have previously pledged an amount, do not check box.

☐	Fuel Fund Donation	$
	Gas Bill Payment	$
	Total Payment	$

Washington Gas
District of Columbia Division

DEC 15 1993

Telephone (703) 750-1000

Please Give Account Number

ACCOUNT NUMBER: 0002.577112 *01

BILLS ARE DUE WHEN RENDERED.

AMOUNT DUE NOW	$ 11,652.00
AMOUNT DUE AFTER DATE BELOW	$ 11,768.52
OVERDUE AFTER	DEC 29, 93 G

DIR OF PUB WRKS
ANPW-OP
BLDG 203, FT MEYER
ARL VA 22211

Nov

000257711211768521165200 2

PLEASE DETACH THIS STUB AND RETURN WITH PAYMENT • MAKE CHECK PAYABLE TO WASHINGTON GAS.

ACCOUNT NUMBER	BILLING PERIOD	DAYS USED	DATE MAILED	NEXT METER READING DATE
0002.577112	OCT 29, 93 DEC 1, 93	33	DEC 8, 93	JAN 3, 94

CURRENT READING METHOD	CURRENT READING	− PREVIOUS READING	+ UNMETERED GAS LIGHT	= CCF OF GAS USED	X THERMS PER CCF	= TOTAL THERMS
READ BY COMPANY	1009262	0994257		15,005	1.021	15,320.1

CHARGES FOR GAS SERVICE AT: 400 P ST SW #LIBR

CURRENT GAS USAGE - 15,320.1 THERMS @ $ .7790	$11,934.36
CUSTOMER CHARGE NON RES HEATING/COOLING LEVEL 2	27.10
PURCHASED GAS ADJUSTMENT @ $ .0247 PER THERM	378.41
INTERRUPTIBLE SALES CREDIT @ $-.0449 PER THERM	687.87CR

A PAYMENT OF $7,721.13 WAS RECEIVED ON 11/30/93.

BUDGET PLAN INFORMATION				
GAS USED THIS PERIOD	TOTAL GAS USED TO DATE	INSTALLMENTS BILLED TO DATE	AMOUNT DUE NOW	$ 11,652.00
$	$	$	AMOUNT DUE AFTER DEC 29, 93	$ 11,768.52

Washington Gas
District of Columbia Division

FOR YOUR RECORDS

CHECK NO. ______________ DATE: ______________

AMOUNT OF CHECK $ ______________

TAX DEDUCTIBLE WAFF CONTRIBUTION $ ______________

ACCOUNT NUMBER 0002.577112 *01

Washington Gas
District of Columbia Division

Telephone (703) 750-1000

Please Give Account Number

ACCOUNT NUMBER	0002.577112 *01

DIR OF PUB WRKS
ANPW-OP
BLDG 203, FT MEYER
ARL VA 22211

Fuel Fund Donation	$	
Gas Bill Payment	$	
Total Payment	$	

BILLS ARE DUE WHEN RENDERED

AMOUNT DUE NOW	$	15,039.45
AMOUNT DUE AFTER DATE BELOW	$	15,189.84
OVERDUE AFTER	JAN 31, 94	G

DEC

000257711215189841503945 9

MAKE CHECK PAYABLE TO WASHINGTON GAS.

ACCOUNT NUMBER	BILLING PERIOD		DAYS USED	DATE MAILED	NEXT METER READING DATE
0002.577112	DEC 1, 93	JAN 3, 94	33	JAN 10, 94	FEB 2, 94

CURRENT READING METHOD	CURRENT READING	− PREVIOUS READING	+ UNMETERED GAS LIGHT	= CCF OF GAS USED	X THERMS PER CCF	= TOTAL THERMS
READ BY COMPANY	1028942	1009262		19,680	1.022	20,113.0

CHARGES FOR GAS SERVICE AT: 400 P ST SW #LIBR

CURRENT GAS USAGE - 20,113.0 THERMS @ $ .7790	$15,668.03
CUSTOMER CHARGE NON RES HEATING/COOLING LEVEL 2	27.10
PURCHASED GAS ADJUSTMENT @ $ .0123 PER THERM	247.39
INTERRUPTIBLE SALES CREDIT @ $-.0449 PER THERM	903.07CF

A PAYMENT OF $11,652.00 WAS RECEIVED ON 01/03/94.

BUDGET PLAN INFORMATION					
GAS USED THIS PERIOD	TOTAL GAS USED TO DATE	INSTALLMENTS BILLED TO DATE	AMOUNT DUE NOW	$	15,039.45
$	$	$	AMOUNT DUE AFTER JAN 31, 94	$	15,189.84

Washington Gas
District of Columbia Division

FOR YOUR RECORDS

CHECK NO ____________ DATE ____________

AMOUNT OF CHECK $ ____________

TAX DEDUCTIBLE WAFF CONTRIBUTION $ ____________

ACCOUNT NUMBER 0002.577112 *01

Washington Gas
District of Columbia Division

Telephone 703/750-1000

Please Give Account Number

ACCOUNT NUMBER 0002.577112 *01

DIR OF PUB WRKS
ANPW-OP
BLDG 203, FT MEYER
ARL VA 22211

FEB 14 1994

Fuel Fund Donation	$
Gas Bill Payment	$
Total Payment	$

AMOUNT DUE NOW	$ 20,750.8 ~~35,790.2~~
AMOUNT DUE AFTER DATE BELOW	$ 36,224.1
OVERDUE AFTER	MAR 2, 94

0002577112362241035790025

MAKE CHECK PAYABLE TO WASHINGTON GAS.

ACCOUNT NUMBER	BILLING PERIOD		DAYS USED	DATE MAILED	NEXT METER READING DATE
0002.577112	JAN 3, 94	FEB 2, 94	30	FEB 9, 94	MAR 4, 94

CURRENT READING METHOD	CURRENT READING	− PREVIOUS READING	− UNMETERED GAS LIGHT	= CCF OF GAS USED	X THERMS PER CCF	= TOTAL THE
READ BY COMPANY	1055212	1028942		26,270	1.031	27,084.

CHARGES FOR GAS SERVICE AT 400 P ST SW #LIBR

BALANCE FROM PREVIOUS BILL Approved 1-21-94	~~$15,039.45~~
LATE PAYMENT CHARGE ASSESSED	150.39
CURRENT GAS USAGE - 27,084.4 THERMS @ $ .7790	21,098.75
CUSTOMER CHARGE NON RES HEATING/COOLING LEVEL 2	27.10
PURCHASED GAS ADJUSTMENT @ $ .0255 PER THERM	690.65
INTERRUPTIBLE SALES CREDIT @ $-.0449 PER THERM	1,216.09
	20,[illegible].41

IF YOU HAVE ANY QUESTIONS, PLEASE CALL US AT (703)750-1000
WE ARE EASIEST TO REACH TUESDAY THROUGH THURSDAY AFTER 10 AM.

20,750.8

BUDGET PLAN INFORMATION				
GAS USED THIS PERIOD	TOTAL GAS USED TO DATE	INSTALLMENTS BILLED TO DATE	AMOUNT DUE NOW	$ ~~35,790.25~~
$	$	$	AMOUNT DUE AFTER MAR 2, 94	$ 36,224.10

Washington Gas
District of Columbia Division

FOR YOUR RECORDS

CHECK NO ________ DATE ________

AMOUNT PAID $ ________

TAX DEDUCTIBLE $ ________

ACCOUNT NUMBER 0002.577112 *01

Washington Gas
District of Columbia Division

Telephone (703) 750-1000

Please Give Account Number

ACCOUNT NUMBER 0002.577112 *01

DIR OF PUB WRKS
ANPW-OP
BLDG 203, FT MEYER
ARL VA 22211

	Fuel Fund Donation	S
	Gas Bill Payment	S
	Total Payment	S

BILLS ARE DUE WHEN RENDERED

AMOUNT DUE NOW	S 18,157. ~~38,419.0~~
AMOUNT DUE AFTER DATE BELOW	S ~~38,908.0~~
OVERDUE AFTER	APR 1, 94

00025771123890808384190

PLEASE DETACH THIS STUB AND RETURN WITH PAYMENT • MAKE CHECK PAYABLE TO WASHINGTON GAS.

ACCOUNT NUMBER	BILLING PERIOD	DAYS USED	DATE MAILED	NEXT METER READING DATE
0002.577112	FEB 2, 94 - MAR 4, 94	30	MAR 11, 94	APR 4, 94

CURRENT READING METHOD	CURRENT READING	- PREVIOUS READING	- UNMETERED GAS LIGHT	= CCF OF GAS USED	X THERMS PER CCF	= TOTAL TH
READ BY COMPANY	1076917	1055212		21,705	1.019	22,117.

CHARGES FOR GAS SERVICE AT 400 P ST SW #LIBR

BALANCE FROM PREVIOUS BILL Paid	~~$20,750.8~~
LATE PAYMENT CHARGE ASSESSED	~~208.2~~
CURRENT GAS USAGE - 22,117.4 THERMS @ $ .7790	17,229.4
CUSTOMER CHARGE NON RES HEATING/COOLING LEVEL 2	27.1
PURCHASED GAS ADJUSTMENT @ $ .0541 PER THERM	1,196.5
INTERRUPTIBLE SALES CREDIT @ $-.0449 PER THERM	993.0

A PAYMENT OF $15,039.45 WAS RECEIVED ON 02/10/94.

IF YOU HAVE ANY QUESTIONS, PLEASE CALL US AT (703)750-1000
WE ARE EASIEST TO REACH TUESDAY THROUGH THURSDAY AFTER 10 AM.

RH $18,157.

BUDGET PLAN INFORMATION				
GAS USED THIS PERIOD	TOTAL GAS USED TO DATE	INSTALLMENTS BILLED TO DATE	AMOUNT DUE NOW	~~$ 38,419.0~~
S	S	S	AMOUNT DUE AFTER APR 1, 94	S ~~38,908.0~~

Washington Gas
District of Columbia Division

FOR YOUR RECORDS

CHECK NO ______ DATE ______

AMOUNT OF CHECK S ______

TAX DEDUCTIBLE WAFF CONTRIBUTION S ______

ACCOUNT NUMBER 0002.577112 *01

Washington Gas
District of Columbia Division

Telephone (703) 750-1000

Please Give Account Number

ACCOUNT NUMBER	0002.577112 *01

DIR OF PUB WRKS
ANPW-OP
BLDG 203, FT MEYER
ARL VA 22211

If you wish to contribute to the Washington Area Fuel Fund, check the box and indicate amount. If previously pledged an amount, do not check box.

☐	Fuel Fund Donation	$
	Gas Bill Payment	$
	Total Payment	$ 11,073.20

BILLS ARE DUE WHEN RENDERED

AMOUNT DUE NOW	$ 29,330.48
AMOUNT DUE AFTER DATE BELOW	$ 29,713.01
OVERDUE AFTER	MAY 2, 94 G

0002577112297130129330480

PLEASE DETACH THIS STUB AND RETURN WITH PAYMENT • MAKE CHECK PAYABLE TO WASHINGTON GAS.

ACCOUNT NUMBER	BILLING PERIOD		DAYS USED	DATE MAILED	NEXT METER READING DATE
0002.577112	MAR 4, 94	APR 4, 94	31	APR 11, 94	MAY 3, 94

CURRENT READING METHOD	CURRENT READING	− PREVIOUS READING	+ UNMETERED GAS LIGHT	= CCF OF GAS USED	X THERMS PER CCF	= TOTAL THERMS
READ BY COMPANY	1091450	1076917		14,533	1.022	14,852.7

CHARGES FOR GAS SERVICE AT: 400 P ST SW #LIBR Paid 3-30-94 −18,157.28

BALANCE FROM PREVIOUS BILL	$17,668.29
LATE PAYMENT CHARGE ASSESSED	177.72
CURRENT GAS USAGE - 14,852.7 THERMS @ $ .7790	11,570.25
CUSTOMER CHARGE NON RES HEATING/COOLING LEVEL 2	27.10
PURCHASED GAS ADJUSTMENT @ $ .0373 PER THERM	554.01
INTERRUPTIBLE SALES CREDIT @ $-.0449 PER THERM	666.89CR
	11,484.47

A PAYMENT OF $20,750.80 WAS RECEIVED ON 03/15/94.

IF YOU HAVE ANY QUESTIONS, PLEASE CALL US AT (703)750-1000
WE ARE EASIEST TO REACH TUESDAY THROUGH THURSDAY AFTER 10 AM.

11,073.20

BUDGET PLAN INFORMATION				
GAS USED THIS PERIOD	TOTAL GAS USED TO DATE	INSTALLMENTS BILLED TO DATE	AMOUNT DUE NOW	$ ~~29,330.48~~
$	$	$	AMOUNT DUE AFTER MAY 2, 94	$ 29,713.01

Washington Gas
District of Columbia Division

FOR YOUR RECORDS

CHECK NO. ______________ DATE. ______________

AMOUNT OF CHECK $ ______________

TAX DEDUCTIBLE WAFF CONTRIBUTION $ ______________

ACCOUNT NUMBER 0002.577112 *01

Washington Gas
District of Columbia Division

Telephone (703) 750-1000

Please Give Account Number

ACCOUNT NUMBER: 0002.577112 *01

DIR OF PUB WRKS
ANPW-OP
BLDG 203, FT MEYER
ARL VA 22211

If you wish to contribute to the Washington Area Fuel Fund, check the box and indicate amount. If you have previously pledged an amount, do not check box.

☐	Fuel Fund Donation	$
	Gas Bill Payment	$
	Total Payment	$

BILLS ARE DUE WHEN RENDERED.

AMOUNT DUE NOW	$ 5,707.60
AMOUNT DUE AFTER DATE BELOW	$ 5,765.19
OVERDUE AFTER	MAY 31, 94 G

0002577112057651905707602

PLEASE DETACH THIS STUB AND RETURN WITH PAYMENT • MAKE CHECK PAYABLE TO WASHINGTON GAS.

ACCOUNT NUMBER	BILLING PERIOD	DAYS USED	DATE MAILED	NEXT METER READING DATE
0002.577112	APR 4, 94 MAY 3, 94	29	MAY 10, 94	JUN 2, 94

CURRENT READING METHOD	CURRENT READING	- PREVIOUS READING	+ UNMETERED GAS LIGHT	= CCF OF GAS USED	X THERMS PER CCF	= TOTAL THERM.
READ BY COMPANY	1098367	1091450		6,917	1.023	7,076.1

CHARGES FOR GAS SERVICE AT: 400 P ST SW #LIBR

BALANCE FROM PREVIOUS BILL	$ 100.00
LATE PAYMENT CHARGE ASSESSED	1.00
CURRENT GAS USAGE - 7,076.1 THERMS @ $ .7790	5,512.28
CUSTOMER CHARGE NON RES HEATING/COOLING LEVEL 2	27.10
PURCHASED GAS ADJUSTMENT @ $ .0544 PER THERM	384.94
INTERRUPTIBLE SALES CREDIT @ $-.0449 PER THERM	317.72CR

A PAYMENT OF $18,157.28 WAS RECEIVED ON 04/22/94.
A PAYMENT OF $11,073.20 WAS RECEIVED ON 04/27/94.

IF YOU HAVE ANY QUESTIONS, PLEASE CALL US AT (703)750-1000
WE ARE EASIEST TO REACH TUESDAY THROUGH THURSDAY AFTER 10 AM.

BUDGET PLAN INFORMATION				
GAS USED THIS PERIOD	TOTAL GAS USED TO DATE	INSTALLMENTS BILLED TO DATE	AMOUNT DUE NOW	$ 5,707.60
$	$	$	AMOUNT DUE AFTER MAY 31, 94	$ 5,765.19

Washington Gas
District of Columbia Division

FOR YOUR RECORDS

CHECK NO. ____________ DATE: ____________

AMOUNT OF CHECK $ ____________

TAX DEDUCTIBLE WAFF CONTRIBUTION $ ____________

ACCOUNT NUMBER 0002.577112 *01

If you wish to contribute to the Washington Area Fuel Fund, check the box and indicate amount

☐	Fuel Fund Donation	$
	Gas Bill Payment	$
	Total Payment	$

Washington Gas
District of Columbia Division

Telephone (703) 750-1000

Please Give Account Number

ACCOUNT NUMBER 0002.577112 *01

DIR OF PUB WRKS
ANPW-OP
BLDG 203, FT MEYER
ARL VA 22211

BILLS ARE DUE WHEN RENDERED

AMOUNT DUE NOW:	$ 3,526.75
AMOUNT DUE AFTER DATE BELOW.	$ 3,562.02
OVERDUE AFTER:	JUN 30, 94 G

0002577112035620203526759

PLEASE DETACH THIS STUB AND RETURN WITH PAYMENT • MAKE CHECK PAYABLE TO WASHINGTON GAS.

ACCOUNT NUMBER	BILLING PERIOD		DAYS USED	DATE MAILED	NEXT METER READING DATE
0002.577112	MAY 3, 94	JUN 2, 94	30	JUN 9, 94	JUL 1, 94

CURRENT READING METHOD	CURRENT READING	− PREVIOUS READING	+ UNMETERED GAS LIGHT	= CCF OF GAS USED	X THERMS PER CCF	= TOTAL THERMS
READ BY COMPANY	1102781	1098367		4,414	1.025	4,524.4

CHARGES FOR GAS SERVICE AT: 400 P ST SW #LIBR

CURRENT GAS USAGE - 4,524.4 THERMS @ $ .7790	$3,524.51
CUSTOMER CHARGE NON RES HEATING/COOLING LEVEL 2	.00
PURCHASED GAS ADJUSTMENT @ $ .0428 PER THERM	193.64
INTERRUPTIBLE SALES CREDIT @ $-.0449 PER THERM	203.15CR
INCREASE IN DC GROSS RECEIPTS TAX	11.75

A PAYMENT OF $5,707.60 WAS RECEIVED ON 05/31/94.

IF YOU HAVE ANY QUESTIONS, PLEASE CALL US AT (703)750-1000
WE ARE EASIEST TO REACH TUESDAY THROUGH THURSDAY AFTER 10 AM.

BUDGET PLAN INFORMATION				
GAS USED THIS PERIOD	TOTAL GAS USED TO DATE	INSTALLMENTS BILLED TO DATE	AMOUNT DUE NOW	$ 3,526.75
$	$	$	AMOUNT DUE AFTER JUN 30, 94	$ 3,562.02

Washington Gas
District of Columbia Division

FOR YOUR RECORDS

CHECK NO ________ DATE ________

AMOUNT OF CHECK $ ________

TAX DEDUCTIBLE WAFF CONTRIBUTION $ ________

ACCOUNT NUMBER 0002.577112 *01

Washington Gas
District of Columbia Division

Telephone (703) 750-1000

Please Give Account Number

ACCOUNT NUMBER: 0002.577112 *01

DIR OF PUB WRKS
ANPW-OP
BLDG 203, FT MEYER
ARL VA 22211

FY 94

If you wish to contribute to the Washington Area Fuel Fund, check the box and indicate amount. If you have previously pledged an amount, do not check box.

Fuel Fund Donation	$	
Gas Bill Payment	$	
Total Payment	$	761.09

BILLS ARE DUE WHEN RENDERED.

AMOUNT DUE NOW	$ ~~4,287.84~~
AMOUNT DUE AFTER DATE BELOW	$ # 761.09 ~~4,348.53~~
OVERDUE AFTER	AUG 1, 94 G

00025771120434853O4287840

PLEASE DETACH THIS STUB AND RETURN WITH PAYMENT • MAKE CHECK PAYABLE TO WASHINGTON GAS.

ACCOUNT NUMBER	BILLING PERIOD		DAYS USED	DATE MAILED	NEXT METER READING DATE
0002.577112	JUN 2, 94	JUL 1, 94	29	JUL 11, 94	AUG 1, 94

CURRENT READING METHOD	CURRENT READING	− PREVIOUS READING	+ UNMETERED GAS LIGHT	= CCF OF GAS USED	X THERMS PER CCF	= TOTAL THERMS
READ BY COMPANY	1103750	1102781		969	1.023	991.3

CHARGES FOR GAS SERVICE AT: 400 P ST SW #LIBR

BALANCE FROM PREVIOUS BILL R.J 6-15-94	~~$3,526.75~~
LATE PAYMENT CHARGE ASSESSED RH	~~35.27~~
CURRENT GAS USAGE - 991.3 THERMS @ $ .7790	772.22
CUSTOMER CHARGE NON RES HEATING/COOLING LEVEL 2	.00
PURCHASED GAS ADJUSTMENT @ $-.0045 PER THERM	4.46C
INTERRUPTIBLE SALES CREDIT @ $-.0449 PER THERM	44.51C
INCREASE IN DC GROSS RECEIPTS TAX	2.57
	725.82

IF YOU HAVE ANY QUESTIONS, PLEASE CALL US AT (703)750-1000
WE ARE EASIEST TO REACH TUESDAY THROUGH THURSDAY AFTER 10 AM.

761.09

BUDGET PLAN INFORMATION				
GAS USED THIS PERIOD	TOTAL GAS USED TO DATE	INSTALLMENTS BILLED TO DATE	AMOUNT DUE NOW	$ ~~4,287.84~~
$	$	$	AMOUNT DUE AFTER AUG 1, 94	$ 4,348.53

Washington Gas
District of Columbia Division

FOR YOUR RECORDS

CHECK NO. ____________ DATE: ____________

AMOUNT OF CHECK $ ____________

TAX DEDUCTIBLE WAFF CONTRIBUTION $ ____________

Washington Gas
District of Columbia Division

Telephone (703) 750-1000

If you wish to contribute to the Washington Area Fuel Fund, check the box and indicate amount. If you have previously pledged an amount, do not check box.

☐	Fuel Fund Donation	$
	Gas Bill Payment	$
	Total Payment	$

Please Give Account Number

ACCOUNT NUMBER: 0002.577112 *01

BILLS ARE DUE WHEN RENDERED.

AMOUNT DUE NOW	$ 1,612.06
AMOUNT DUE AFTER DATE BELOW	$ 1,628.18
OVERDUE AFTER	AUG 29, 94 G

DIR OF PUB WRKS
ANPW-OP
BLDG 203, FT MEYER
ARL VA 22211

000257711201628180161206

PLEASE DETACH THIS STUB AND RETURN WITH PAYMENT • MAKE CHECK PAYABLE TO WASHINGTON GAS.

ACCOUNT NUMBER	BILLING PERIOD		DAYS USED	DATE MAILED	NEXT METER READING DATE
0002.577112	JUL 1, 94	AUG 1, 94	31	AUG 8, 94	AUG 30, 94

CURRENT READING METHOD	CURRENT READING −	PREVIOUS READING +	UNMETERED GAS LIGHT =	CCF OF GAS USED X	THERMS PER CCF =	TOTAL THERMS
READ BY COMPANY	1105870	1103750		2,120	1.020	2,162.4

CHARGES FOR GAS SERVICE AT: 400 P ST SW #LIBR

CURRENT GAS USAGE - 2,162.4 THERMS @ $ .7790	$1,684.51
CUSTOMER CHARGE NON RES HEATING/COOLING LEVEL 2	.00
PURCHASED GAS ADJUSTMENT @ $ .0088 PER THERM	19.03
INTERRUPTIBLE SALES CREDIT @ $-.0449 PER THERM	97.09CR
INCREASE IN DC GROSS RECEIPTS TAX	5.61

A PAYMENT OF $3,526.75 WAS RECEIVED ON 07/12/94.
A PAYMENT OF $761.09 WAS RECEIVED ON 07/25/94.

IF YOU HAVE ANY QUESTIONS, PLEASE CALL US AT (703)750-1000
WE ARE EASIEST TO REACH TUESDAY THROUGH THURSDAY AFTER 10 AM.

BUDGET PLAN INFORMATION				
GAS USED THIS PERIOD	TOTAL GAS USED TO DATE	INSTALLMENTS BILLED TO DATE	AMOUNT DUE NOW	$ 1,612.06
$	$	$	AMOUNT DUE AFTER AUG 29, 94	$ 1,628.18

Washington Gas
District of Columbia Division

FOR YOUR RECORDS

CHECK NO. ____________ DATE: ____________

AMOUNT OF CHECK $ ____________

TAX DEDUCTIBLE WAFF CONTRIBUTION $ ____________

Washington Gas
District of Columbia Division

Telephone (703) 750-1000

Please Give Account Number

ACCOUNT NUMBER 0002.577112 *01

DIR OF PUB WRKS
ANPW-OP
BLDG 203, FT MEYER
ARL VA 22211

If you wish to contribute to the Washington Area Fuel Fund, check the box and indicate amount.

☐	Fuel Fund Donation	$
	Gas Bill Payment	$
	Total Payment	$

BILLS ARE DUE WHEN RENDERED

AMOUNT DUE NOW	$ 1,311.80
AMOUNT DUE AFTER DATE BELOW	$ 1,324.92
OVERDUE AFTER	SEP 28, 94 G

0002577112013249201311808

PLEASE DETACH THIS STUB AND RETURN WITH PAYMENT • MAKE CHECK PAYABLE TO WASHINGTON GAS.

ACCOUNT NUMBER	BILLING PERIOD		DAYS USED	DATE MAILED	NEXT METER READING DATE
0002.577112	AUG 1, 94	AUG 30, 94	29	SEP 7, 94	SEP 29, 94

CURRENT READING METHOD	CURRENT READING	− PREVIOUS READING	+ UNMETERED GAS LIGHT	= CCF OF GAS USED	X THERMS PER CCF	= TOTAL THERMS
READ BY COMPANY	1107631	1105870		1,761	1.021	1,798.0

CHARGES FOR GAS SERVICE AT: 400 P ST SW #LIBR

CURRENT GAS USAGE - 1,798.0 THERMS @ $ .8160	$1,467.17
CUSTOMER CHARGE NON RES HEATING/COOLING LEVEL 2	27.90
PURCHASED GAS ADJUSTMENT @ $-.0598 PER THERM	107.52CR
INTERRUPTIBLE SALES CREDIT @ $-.0449 PER THERM	80.73CR
INCREASE IN DC GROSS RECEIPTS TAX	4.98

A PAYMENT OF $1,612.06 WAS RECEIVED ON 08/23/94.

IF YOU HAVE ANY QUESTIONS, PLEASE CALL US AT (703)750-1000
WE ARE EASIEST TO REACH TUESDAY THROUGH THURSDAY AFTER 10 AM.

BUDGET PLAN INFORMATION				
GAS USED THIS PERIOD	TOTAL GAS USED TO DATE	INSTALLMENTS BILLED TO DATE	AMOUNT DUE NOW	$ 1,311.80
$	$	$	AMOUNT DUE AFTER SEP 28, 94	$ 1,324.92

Washington Gas
District of Columbia Division

FOR YOUR RECORDS

CHECK NO ________ DATE ________

AMOUNT OF CHECK $ ________

TAX DEDUCTIBLE ... $ ________

ACCOUNT NUMBER 0002.577112 *01

Washington Gas
District of Columbia Division

Telephone (703) 750-1000

Please Give Account Number

ACCOUNT NUMBER	0002.577112 *01

DIR OF PUB WRKS
ANPW-OP
BLDG 203, FT MEYER
ARL VA 22211

If you wish to contribute to the Washington Area Fuel Fund, check the box and indicate amount. If you have previously checked an amount, do not check box.

☐	Fuel Fund Donation	$
	Gas Bill Payment	$
	Total Payment	$

BILLS ARE DUE WHEN RENDERED

AMOUNT DUE NOW	$ 2,552.85
AMOUNT DUE AFTER DATE BELOW	$ 2,578.38
OVERDUE AFTER	OCT 27, 94 G

0002577112025783802552854

PLEASE DETACH THIS STUB AND RETURN WITH PAYMENT • MAKE CHECK PAYABLE TO WASHINGTON GAS.

ACCOUNT NUMBER	BILLING PERIOD		DAYS USED	DATE MAILED	NEXT METER READING DATE
0002.577112	AUG 30, 94	SEP 29, 94	30	OCT 6, 94	OCT 28, 94

CURRENT READING METHOD	CURRENT READING −	PREVIOUS READING +	UNMETERED GAS LIGHT =	CCF OF GAS USED X	THERMS PER CCF =	TOTAL THERMS
READ BY COMPANY	1111012	1107631		3,381	1.021	3,452.0

CHARGES FOR GAS SERVICE AT: 400 P ST SW #LIBR

CURRENT GAS USAGE - 3,452.0 THERMS @ $ .8160	$2,816.83
CUSTOMER CHARGE NON RES HEATING/COOLING LEVEL 2	27.90
PURCHASED GAS ADJUSTMENT @ $-.0476 PER THERM	164.32C
INTERRUPTIBLE SALES CREDIT @ $-.0397 PER THERM	137.04C
INCREASE IN DC GROSS RECEIPTS TAX	9.48

A PAYMENT OF $1,311.80 WAS RECEIVED ON 09/23/94.

IF YOU HAVE ANY QUESTIONS, PLEASE CALL US AT (703)750-1000
WE ARE EASIEST TO REACH TUESDAY THROUGH THURSDAY AFTER 10 AM.

√

BUDGET PLAN INFORMATION				
GAS USED THIS PERIOD	TOTAL GAS USED TO DATE	INSTALLMENTS BILLED TO DATE	AMOUNT DUE NOW	$ 2,552.85
$	$	$	AMOUNT DUE AFTER OCT 27, 94	$ 2,578.38

Washington Gas
District of Columbia Division

FOR YOUR RECORDS

CHECK NO. ____________ DATE ____________

AMOUNT OF CHECK $ ____________

TAX DEDUCTIBLE WAFF CONTRIBUTION $ ____________

ACCOUNT NUMBER 0002.577112 *01

ATTACHMENT 10.5
LCCID DATA (RECOMMENDED ECOS)

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#1
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 8000.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 1000.		
D. TOTAL COST (1A+1B+1C)	$ 9000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 9000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 11.68	0.	$ 0.	18.39	$ 0.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	1740.	$ 13224.	25.93	$ 342898.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-8250.	$ 13224.		$ 342898.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 13224.

5. SIMPLE PAYBACK PERIOD (1G/4) .68 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 342898.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 38.10
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 19.26 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#2
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 45000.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 5000.		
D. TOTAL COST (1A+1B+1C)	$ 50000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 50000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 11.68	2919.	$ 34094.	18.39	$ 626987.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	3140.	$ 23864.	25.93	$ 618794.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-3931.	$ 57958.		$ 1245781.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 57958.

5. SIMPLE PAYBACK PERIOD (1G/4) .86 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 1245781.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 24.92
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 17.25 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#3
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 14000.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 0.		
D. TOTAL COST (1A+1B+1C)	$ 14000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 14000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 20.10	90.	$ 1809.	18.39	$ 33268.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	1259.	$ 9568.	25.93	$ 248109.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-8641.	$ 11377.		$ 281376.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 11377.

5. SIMPLE PAYBACK PERIOD (1G/4) 1.23 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 281376.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 20.10
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 16.25 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#4
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 6000.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 1000.		
D. TOTAL COST (1A+1B+1C)	$ 7000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 7000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.66	244.	$ 2601.	18.39	$ 47833.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-9746.	$ 2601.		$ 47833.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 2601.

5. SIMPLE PAYBACK PERIOD (1G/4) 2.69 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 47833.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 6.83
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 11.34 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#4A
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 70000.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 7000.		
D. TOTAL COST (1A+1B+1C)	$ 77000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 77000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 11.06	1790.	$ 19797.	18.39	$ 364074.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-8200.	$ 19797.		$ 364074.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 19797.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.89 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 364074.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 4.73
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 9.71 %

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: BRIAN

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.080

INSTALLATION & LOCATION: FT. MCNAIR   REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.04   MARSHALL HALL

FISCAL YEAR 1995   DISCRETE PORTION NAME: ECO#5

ANALYSIS DATE: 08-25-95   ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST $ 22000.
B. SIOH $ 0.
C. DESIGN COST $ 3000.
D. TOTAL COST (1A+1B+1C) $ 25000.
E. SALVAGE VALUE OF EXISTING EQUIPMENT $ 0.
F. PUBLIC UTILITY COMPANY REBATE $ 0.
G. TOTAL INVESTMENT (1D - 1E - 1F) $ 25000.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 26.70	427.	$ 11401.	18.39	$ 209663.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	-657.	$ -4993.	25.93	$ -129474.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-10220.	$ 6408.		$ 80189.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 6408.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.90 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 80189.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 3.21
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 8.02 %

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#6
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 15000.			
B. SIOH	$ 0.			
C. DESIGN COST	$ 1000.			
D. TOTAL COST (1A+1B+1C)	$ 16000.			
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$	0.	
F. PUBLIC UTILITY COMPANY REBATE		$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)				$ 16000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 22.10	199.	$ 4398.	18.39	$ 80877.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-9791.	$ 4398.		$ 80877.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) — $ 0.
(1) DISCOUNT FACTOR (TABLE A) — 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) — $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 4398.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.64 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 80877.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 5.05
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 10.00 %

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: BRIAN

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.080

INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.04 MARSHALL HALL

FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#7

ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 18000.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 2000.		
D. TOTAL COST (1A+1B+1C)	$ 20000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 20000.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 38.27	175.	$ 6697.	18.39	$ 123162.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	-218.	$ -1657.	25.93	$ -42961.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-10033.	$ 5040.		$ 80202.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) — $ 0.

(1) DISCOUNT FACTOR (TABLE A) — 17.22

(2) DISCOUNTED SAVING/COST (3A X 3A1) — $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 5040.

5. SIMPLE PAYBACK PERIOD (1G/4) — 3.97 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) — $ 80202.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 4.01

(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 8.99 %

LIFE CYCLE COST ANALYSIS SUMMARY   STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)   LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR   REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04   MARSHALL HALL
FISCAL YEAR 1995   DISCRETE PORTION NAME: ECO#8
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 5900.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 600.		
D. TOTAL COST (1A+1B+1C)	$ 6500.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 6500.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 16.67	72.	$ 1200.	18.39	$ 22072.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-9918.	$ 1200.		$ 22072.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A)   17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 1200.

5. SIMPLE PAYBACK PERIOD (1G/4)   5.42 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 22072.

7. SAVINGS TO INVESTMENT RATIO   (SIR)=(6 / 1G)=   3.40
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):   8.27 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#9
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 187600.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 22400.		
D. TOTAL COST (1A+1B+1C)	$ 210000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 210000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 27.48	1263.	$ 34707.	18.39	$ 638266.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-8727.	$ 34707.		$ 638266.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 34707.

5. SIMPLE PAYBACK PERIOD (1G/4) 6.05 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 638266.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 3.04
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 7.79 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#10
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 123300.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 14600.		
D. TOTAL COST (1A+1B+1C)	$ 137900.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 137900.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 27.45	714.	$ 19599.	18.39	$ 360431.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-9276.	$ 19599.		$ 360431.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	17.22	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 19599.

5. SIMPLE PAYBACK PERIOD (1G/4) 7.04 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 360431.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 2.61
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 7.14 %

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#11
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 700.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 100.		
D. TOTAL COST (1A+1B+1C)	$ 800.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 800.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 12.00	8.	$ 96.	18.39	$ 1765.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-9982.	$ 96.		$ 1765.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 110.
(1) DISCOUNT FACTOR (TABLE A)	17.22	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 1894.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 1894.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 206.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.88 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 3660.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 4.57
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 9.57 %

LIFE CYCLE COST ANALYSIS SUMMARY   STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)   LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR   REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04   MARSHALL HALL
FISCAL YEAR 1995   DISCRETE PORTION NAME: ECO#12
ANALYSIS DATE: 08-25-95   ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT
A. CONSTRUCTION COST $ 6100.
B. SIOH $ 0.
C. DESIGN COST $ 400.
D. TOTAL COST (1A+1B+1C) $ 6500.
E. SALVAGE VALUE OF EXISTING EQUIPMENT $ 0.
F. PUBLIC UTILITY COMPANY REBATE $ 0.
G. TOTAL INVESTMENT (1D - 1E - 1F) $ 6500.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 29.81	23.	$ 686.	18.39	$ 12609.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-9967.	$ 686.		$ 12609.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 686.

5. SIMPLE PAYBACK PERIOD (1G/4) 9.48 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 12609.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 1.94
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 5.87 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#13
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 14100.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 900.		
D. TOTAL COST (1A+1B+1C)	$ 15000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 15000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 14.96	160.	$ 2394.	18.39	$ 44018.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-9830.	$ 2394.		$ 44018.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	17.22	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 2394.

5. SIMPLE PAYBACK PERIOD (1G/4) 6.27 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 44018.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 2.93
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 7.64 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#14
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT
A. CONSTRUCTION COST $ 12600.
B. SIOH $ 0.
C. DESIGN COST $ 400.
D. TOTAL COST (1A+1B+1C) $ 13000.
E. SALVAGE VALUE OF EXISTING EQUIPMENT $ 0.
F. PUBLIC UTILITY COMPANY REBATE $ 0.
G. TOTAL INVESTMENT (1D - 1E - 1F) $ 13000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 15.61	51.	$ 796.	18.39	$ 14640.
B. DIST	$ .00	-999.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-9939.	$ 796.		$ 14640.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 1000.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 17220.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 17220.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))$ 1796.

5. SIMPLE PAYBACK PERIOD (1G/4) 7.24 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 31860.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 2.45
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 6.86 %

ATTACHMENT 10.6
LCCID DATA (NOT RECOMMENDED ECOS)

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#A
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 5900.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 600.		
D. TOTAL COST (1A+1B+1C)	$ 6500.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 6500.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 16.66	24.	$ 400.	18.39	$ 7353.
B. DIST	$ 4.33	0.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-7968.	$ 400.		$ 7353.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 400.

5. SIMPLE PAYBACK PERIOD (1G/4) 16.26 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 7353.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 1.13
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 3.61 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#B
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 17600.	
B. SIOH	$ 0.	
C. DESIGN COST	$ 1400.	
D. TOTAL COST (1A+1B+1C)	$ 19000.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.	
F. PUBLIC UTILITY COMPANY REBATE	$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 19000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 26.93	41.	$ 1104.	18.39	$ 20305.
B. DIST	$ 4.33	0.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-7951.	$ 1104.		$ 20305.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	17.22	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 1104.

5. SIMPLE PAYBACK PERIOD (1G/4) 17.21 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 20305.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 1.07
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 3.37 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#C
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 700.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 100.		
D. TOTAL COST (1A+1B+1C)	$ 800.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 800.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 12.55	6.	$ 75.	18.39	$ 1385.
B. DIST	$ 4.33	0.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-7986.	$ 75.		$ 1385.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 110.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 1894.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 1894.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 185.

5. SIMPLE PAYBACK PERIOD (1G/4) 4.32 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 3279.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 4.10
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 9.08 %

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: BRIAN2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.080

INSTALLATION & LOCATION: FT. MCNAIR   REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.04   MARSHALL HALL

FISCAL YEAR 1995   DISCRETE PORTION NAME: ECO#D

ANALYSIS DATE: 08-25-95   ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 14600.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 1400.		
D. TOTAL COST (1A+1B+1C)	$ 16000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 16000.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 12.55	35.	$ 439.	18.39	$ 8078.
B. DIST	$ 4.33	0.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-7957.	$ 439.		$ 8078.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.

(1) DISCOUNT FACTOR (TABLE A) 17.22

(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 439.

5. SIMPLE PAYBACK PERIOD (1G/4) 36.43 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 8078.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= .50
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): .32 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#E
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 80000.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 10000.		
D. TOTAL COST (1A+1B+1C)	$ 90000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 90000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 11.78	1994.	$ 23489.	18.39	$ 431969.
B. DIST	$ 4.33	0.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-5998.	$ 23489.		$ 431969.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 23489.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.83 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 431969.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 4.80
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 9.78 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#F
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT
A. CONSTRUCTION COST $ 10800.
B. SIOH $ 0.
C. DESIGN COST $ 1200.
D. TOTAL COST (1A+1B+1C) $ 12000.
E. SALVAGE VALUE OF EXISTING EQUIPMENT $ 0.
F. PUBLIC UTILITY COMPANY REBATE $ 0.
G. TOTAL INVESTMENT (1D - 1E - 1F) $ 12000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 8.02	175.	$ 1404.	18.39	$ 25810.
B. DIST	$ 4.33	0.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-7817.	$ 1404.		$ 25810.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 1404.

5. SIMPLE PAYBACK PERIOD (1G/4) 8.55 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 25810.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 2.15
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 6.31 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#G
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 98000.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 12000.		
D. TOTAL COST (1A+1B+1C)	$ 110000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 110000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 12.31	723.	$ 8900.	18.39	$ 163673.
B. DIST	$ 4.33	0.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-7269.	$ 8900.		$ 163673.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	17.22	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 8900.

5. SIMPLE PAYBACK PERIOD (1G/4) 12.36 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 163673.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 1.49
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 4.75 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#H
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 130000.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 15000.		
D. TOTAL COST (1A+1B+1C)	$ 145000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 145000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 39.49	462.	$ 18244.	18.39	$ 335514.
B. DIST	$ 4.33	-1540.	$ -6668.	21.10	$ -140699.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-9070.	$ 11576.		$ 194815.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 11576.

5. SIMPLE PAYBACK PERIOD (1G/4) 12.53 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 194815.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 1.34
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 4.33 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#I
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 260000.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 30000.		
D. TOTAL COST (1A+1B+1C)	$ 290000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 290000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$111.62	0.	$ 0.	18.39	$ 0.
B. DIST	$ 4.33	0.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 10300.	17.22	$ 177366.
N. TOTAL		-7992.	$ 10300.		$ 177366.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 10300.

5. SIMPLE PAYBACK PERIOD (1G/4) 28.16 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 177366.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= .61
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 1.09 %

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: BRIAN2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.080

INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.04 MARSHALL HALL

FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#J

ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 20000.	
B. SIOH	$ 0.	
C. DESIGN COST	$ 2000.	
D. TOTAL COST (1A+1B+1C)	$ 22000.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.	
F. PUBLIC UTILITY COMPANY REBATE	$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 22000.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$111.62	0.	$ 0.	18.39	$ 0.
B. DIST	$ 4.33	0.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	150.	$ 1140.	25.93	$ 29560.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-7842.	$ 1140.		$ 29560.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) — $ 0.
 (1) DISCOUNT FACTOR (TABLE A) — 17.22
 (2) DISCOUNTED SAVING/COST (3A X 3A1) — $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 1140.

5. SIMPLE PAYBACK PERIOD (1G/4) 19.30 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 29560.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 1.34
 (IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 4.33 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BRIAN2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04 MARSHALL HALL
FISCAL YEAR 1995 DISCRETE PORTION NAME: ECO#K
ANALYSIS DATE: 08-25-95 ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 130000.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 15000.		
D. TOTAL COST (1A+1B+1C)	$ 145000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 145000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$111.62	86.	$ 9599.	18.39	$ 176532.
B. DIST	$ 4.33	-287.	$ -1243.	21.10	$ -26221.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 0.	17.22	$ 0.
N. TOTAL		-8193.	$ 8357.		$ 150310.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 8357.

5. SIMPLE PAYBACK PERIOD (1G/4) 17.35 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 150310.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 1.04
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 3.25 %

LIFE CYCLE COST ANALYSIS SUMMARY   STUDY: BRIAN2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)   LCCID 1.080
INSTALLATION & LOCATION: FT. MCNAIR   REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: 4130.04   MARSHALL HALL
FISCAL YEAR 1995   DISCRETE PORTION NAME: ECO#L
ANALYSIS DATE: 08-25-95   ECONOMIC LIFE 25 YEARS PREPARED BY: BRIAN PRITZ

1. INVESTMENT

A. CONSTRUCTION COST	$ 450000.		
B. SIOH	$ 0.		
C. DESIGN COST	$ 50000.		
D. TOTAL COST (1A+1B+1C)	$ 500000.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 500000.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$111.62	0.	$ 0.	18.39	$ 0.
B. DIST	$ 4.33	0.	$ 0.	21.10	$ 0.
C. RESID	$ .00	-999.	$ 0.	24.60	$ 0.
D. NAT G	$ 7.60	0.	$ 0.	25.93	$ 0.
E. COAL	$ .00	-999.	$ 0.	21.24	$ 0.
F. LPG	$ .00	-999.	$ 0.	19.17	$ 0.
M. DEMAND SAVINGS			$ 55400.	17.22	$ 953988.
N. TOTAL		-7992.	$ 55400.		$ 953988.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A)   17.22
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 55400.

5. SIMPLE PAYBACK PERIOD (1G/4)   9.03 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 953988.

7. SAVINGS TO INVESTMENT RATIO   (SIR)=(6 / 1G)=   1.91
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):   5.80 %

ATTACHMENT 10.7
EZDOE DATA

REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE WEATHER FILE- PATUXENT, MD

ENERGY TYPE IN SITE MBTU -	ELECTRICITY	NATURAL-GAS
CATEGORY OF USE		
SPACE HEAT	279.37	8739.10
SPACE COOL	3681.63	0.00
HVAC AUX	4181.41	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	5539.87	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	2175.63	0.00
TOTAL	15857.93	8739.10

TOTAL SITE ENERGY	24596.86 MBTU	111.3 KBTU/SQFT-YR GROSS-AREA	111.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY	56360.00 MBTU	255.1 KBTU/SQFT-YR GROSS-AREA	255.1 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =100.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0

NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

REPORT- SV-A SYSTEM DESIGN PARAMETERS AHU_1N WEATHER FILE- PATUXENT, MD

SYSTEM NAME	ALTITUDE MULTIPLIER
AHU_1N	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
5303.	1.849	1.1	5303.	1.232	0.7	0.103	173.690	0.755	-116.924	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AHU1N_L	5303.	0.	0.000	1.000	548.	0.00	0.00	85.90	0.00	-85.90	1.0

SYSTEM NAME	ALTITUDE MULTIPLIER
AHU_1S	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
12019.	4.190	1.1	12019.	2.793	0.7	0.013	345.937	0.808	-189.067	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AHU1S_L	12019.	0.	0.000	1.000	155.	0.00	0.00	194.71	0.00	-194.71	1.0

SYSTEM NAME	ALTITUDE MULTIPLIER
AHU_2	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
35956.	20.613	1.8	24969.	7.738	1.0	0.306	1434.294	0.698	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AHU2_1ST	35956.	10987.	0.860	0.350	10987.	0.00	0.00	582.49	-1553.30	-970.81	1.0

SYSTEM NAME	ALTITUDE MULTIPLIER
AHU_3	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
18180.	10.704	1.8	16140.	5.002	1.0	0.318	734.723	0.696	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AHU3_1ST	10584.	0.	0.000	0.350	2918.	0.00	0.00	171.47	-457.25	-285.78	1.0
AHU3_2ND	2966.	0.	0.000	0.350	818.	0.00	0.00	48.04	-128.11	-80.07	1.0
AHU3_3RD	4630.	2040.	0.080	0.350	2040.	0.00	0.00	75.01	-200.02	-125.01	1.0

REPORT- SV-A SYSTEM DESIGN PARAMETERS AHU_4 WEATHER FILE- PATUXENT, MD

SYSTEM NAME	ALTITUDE MULTIPLIER
AHU_4	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
11150.	6.047	1.7	10793.	2.508	0.7	0.509	471.097	0.695	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AHU4_1ST	11150.	358.	0.014	0.350	5672.	0.00	0.00	180.64	-481.70	-301.06	1.0

REPORT- SV-A SYSTEM DESIGN PARAMETERS AHU_5 WEATHER FILE- PATUXENT, MD

SYSTEM NAME	ALTITUDE MULTIPLIER
AHU_5	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
26664.	17.765	2.1	22624.	7.011	1.0	0.313	1090.627	0.692	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AHU5_1ST	5553.	1806.	0.071	0.350	1806.	0.00	0.00	89.95	-239.87	-149.92	1.0
AHU5_2ND	6799.	1112.	0.044	0.350	2066.	0.00	0.00	110.14	-293.70	-183.56	1.0
AHU5_3RD	6131.	1122.	0.044	0.350	1850.	0.00	0.00	99.32	-264.85	-165.53	1.0
AHU5_ATR	8182.	0.	0.000	0.350	2636.	0.00	0.00	132.55	-123.71	-77.32	1.0

SYSTEM NAME	ALTITUDE MULTIPLIER
AHU_6	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
45198.	32.214	2.2	42555.	13.187	1.0	0.203	1760.742	0.698	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AHU6_2ND	27408.	423.	0.017	0.350	5572.	0.00	0.00	444.01	-1184.02	-740.01	1.0
AHU6_3RD	17790.	2219.	0.174	0.350	3617.	0.00	0.00	288.19	-768.51	-480.32	1.0

SYSTEM NAME	ALTITUDE MULTIPLIER
AHU_7	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
5656.	2.892	1.6	5656.	1.315	0.7	1.000	248.563	0.685	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AHU7_1ST	3177.	0.	0.000	0.350	3177.	0.00	0.00	51.47	-137.24	-85.78	1.0
AHU7_2ND	2479.	0.	0.000	0.350	2479.	0.00	0.00	40.16	-107.10	-66.94	1.0

SYSTEM NAME	ALTITUDE MULTIPLIER
AHU_8	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
21513.	12.667	1.8	20161.	6.248	1.0	0.204	819.797	0.707	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AHU8_1ST	8048.	562.	0.022	0.350	1642.	0.00	0.00	130.38	-347.67	-217.29	1.0
AHU8_2ND	5781.	358.	0.014	0.350	1179.	0.00	0.00	93.65	-249.75	-156.09	1.0
AHU8_3RD	7684.	433.	0.017	0.350	1567.	0.00	0.00	124.48	-331.95	-207.47	1.0

REPORT- SV-A SYSTEM DESIGN PARAMETERS AHU_9 WEATHER FILE- PATUXENT, MD

SYSTEM NAME	ALTITUDE MULTIPLIER
AHU_9	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
2020.	1.565	2.4	1254.	0.292	0.7	0.379	85.126	0.694	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AHU9_3RD	2020.	766.	0.030	1.000	766.	0.00	0.00	21.82	-87.26	-65.45	1.0

REPORT- SV-A SYSTEM DESIGN PARAMETERS FC_1 WEATHER FILE- PATUXENT, MD

SYSTEM NAME	ALTITUDE MULTIPLIER
FC_1	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
626.	0.000	0.2	0.	0.000	0.0	0.000	0.000	0.000	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
FC1_3RD	626.	0.	0.039	1.000	0.	19.61	0.76	13.20	-19.71	-19.84	1.0

SYSTEM NAME	ALTITUDE MULTIPLIER
FC_2	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
182.	0.000	0.2	0.	0.000	0.0	0.000	0.000	0.000	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
FC2_3RD	182.	0.	0.011	1.000	0.	6.00	0.74	3.75	-5.72	-5.76	1.0

SYSTEM NAME	ALTITUDE MULTIPLIER
FC_3	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
162.	0.000	0.1	0.	0.000	0.0	0.000	0.000	0.000	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
FC3_3RD	162.	0.	0.005	1.000	0.	5.16	0.75	3.26	-5.11	-5.12	1.0

SYSTEM NAME	ALTITUDE MULTIPLIER
FC_4	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
192.	0.000	0.1	0.	0.000	0.0	0.000	0.000	0.000	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
FC4_3RD	192.	0.	0.006	1.000	0.	6.09	0.75	3.98	-6.06	-6.08	1.0

REPORT- SV-A SYSTEM DESIGN PARAMETERS FC_5 WEATHER FILE- PATUXENT, MD

SYSTEM NAME	ALTITUDE MULTIPLIER
FC_5	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
0.	0.000	0.0	0.	0.000	0.0	0.000	4.200	0.000	-2.400	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
FC5_1ST	0.	0.	0.000	1.000	0.	4.20	0.00	0.00	-2.40	-2.40	1.0

REPORT- SV-A SYSTEM DESIGN PARAMETERS AC_1 WEATHER FILE- PATUXENT, MD

SYSTEM NAME	ALTITUDE MULTIPLIER
AC_1	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
374.	0.017	0.1	0.	0.000	0.0	0.000	10.999	0.800	-11.788	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AC1_1ST	374.	0.	0.000	1.000	0.	0.00	0.00	8.07	0.00	-12.11	1.0

REPORT- SV-A SYSTEM DESIGN PARAMETERS AC_2 WEATHER FILE- PATUXENT, MD

SYSTEM NAME	ALTITUDE MULTIPLIER
AC_2	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
40.	0.000	0.2	0.	0.000	0.0	0.000	0.000	0.000	0.000	0.44	0.37

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AC2_1ST	40.	0.	0.003	1.000	0.	1.12	0.70	0.81	-1.27	-1.28	1.0

SYSTEM NAME	ALTITUDE MULTIPLIER
AC_3	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
131.	0.006	0.1	0.	0.000	0.0	0.000	3.908	0.795	-4.142	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
AC3_3RD	131.	0.	0.000	1.000	0.	0.00	0.00	2.84	0.00	-4.25	1.0

SYSTEM NAME	ALTITUDE MULTIPLIER
MECH_RM	1.010

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
374.	0.000	0.2	0.	0.000	0.0	0.000	0.000	0.000	0.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
MECH_RMS	374.	0.	0.022	1.000	0.	0.00	0.00	0.00	-15.86	-15.71	1.0

ENTECH ENGINEERING   EZDOE - ELITE SOFTWARE DEVELOPMENT INC   DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603   FT. McNAIR   GEORGE C. MARSHALL HALL
REPORT- SS-D PLANT MONTHLY LOADS SUMMARY FOR   DEFAULT-PLANT   WEATHER FILE- PATUXENT, MD

	- - - - - - - - C O O L I N G - - - - - - - -						- - - - - - - - H E A T I N G - - - - - - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	334.29602	26	15	62.F	51.F	1259.769	-1348.935	17	22	-1.F	-2.F	-4180.504	274583.	604.624
FEB	310.13956	22	13	67.F	62.F	1703.565	-949.386	5	7	22.F	19.F	-3132.747	248860.	605.832
MAR	494.71790	9	16	80.F	68.F	3200.334	-674.663	31	6	26.F	20.F	-2646.957	283780.	611.182
APR	632.29883	14	17	79.F	55.F	2549.834	-346.075	2	6	36.F	31.F	-1782.392	270239.	612.103
MAY	1107.30017	3	14	68.F	67.F	2796.800	-153.260	10	7	51.F	48.F	-634.078	280698.	613.354
JUN	1567.96753	30	16	91.F	77.F	4319.412	-56.632	29	7	65.F	61.F	-175.349	271729.	609.500
JUL	2010.90063	14	17	92.F	76.F	4201.465	-76.611	18	6	68.F	65.F	-187.644	266239.	566.087
AUG	1965.23901	18	17	93.F	82.F	5190.852	-69.801	8	7	68.F	67.F	-197.494	276037.	566.609
SEP	1360.57373	2	15	86.F	76.F	4084.957	-57.415	30	6	49.F	47.F	-267.279	269705.	608.768
OCT	912.09991	11	17	81.F	66.F	3114.590	-278.544	27	7	38.F	32.F	-1712.891	276284.	612.544
NOV	488.08337	4	14	67.F	63.F	2213.114	-583.074	28	7	34.F	28.F	-2292.054	268788.	611.056
DEC	335.30582	2	13	66.F	56.F	1441.414	-999.568	27	2	22.F	19.F	-2992.235	275627.	604.452
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TOTAL	11518.899						-5593.958						3262571.	
MAX						5190.852						-4180.504		613.354

ENTECH ENGINEERING   EZDOE - ELITE SOFTWARE DEVELOPMENT INC   DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1

READING, PA 19603   FT. McNAIR   GEORGE C. MARSHALL HALL

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR   AHU_1N   WEATHER FILE- PATUXENT, MD

	- - - - C O O L I N G - - - -						- - - - H E A T I N G - - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.11368	22	16	47.F	44.F	14.843	-34.252	31	7	16.F	13.F	-101.323	2876.	4.419
FEB	0.97016	28	16	63.F	46.F	34.550	-22.343	3	7	34.F	34.F	-88.387	2598.	4.419
MAR	6.62532	9	16	80.F	68.F	78.509	-11.926	4	7	44.F	44.F	-56.213	2894.	4.419
APR	15.19928	19	16	72.F	57.F	101.784	-4.300	8	7	50.F	48.F	-50.681	2789.	4.419
MAY	30.76128	6	18	66.F	57.F	109.145	-0.649	10	6	52.F	48.F	-34.420	2876.	4.419
JUN	43.19937	25	18	85.F	78.F	144.739	0.000					0.000	2798.	4.419
JUL	52.70111	14	18	90.F	76.F	140.018	0.000					0.000	2867.	4.419
AUG	46.31067	18	17	93.F	82.F	150.832	0.000					0.000	2894.	4.419
SEP	27.25512	7	18	86.F	76.F	132.705	0.000					0.000	2789.	4.419
OCT	14.18487	11	17	81.F	66.F	90.923	-3.533	28	8	46.F	37.F	-42.200	2867.	4.419
NOV	2.99289	2	16	59.F	56.F	59.581	-14.426	23	7	39.F	36.F	-57.651	2780.	4.419
DEC	0.00489	27	15	41.F	32.F	4.889	-30.282	7	7	30.F	26.F	-76.259	2876.	4.419
TOTAL	240.318						-121.711						33908.	
MAX						150.832						-101.323		4.419

REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AHU_1N WEATHER FILE- PATUXENT, MD

	- -Z O N E C O O L I N G- -		- -Z O N E H E A T I N G-		- - B A S E B O A R D S - -		- - - -P R E - H E A T - - -	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
FEB	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAR	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
APR	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAY	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
NOV	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
DEC	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
TOTAL	0.000		0.000		0.000		0.000	
MAX		0.000		0.000		0.000		0.000

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AHU_1S WEATHER FILE- PATUXENT, MD

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	16.45306	26	17	61.F	52.F	28.948	-1.246	29	24	25.F	19.F	-3.243	6201.	9.289
FEB	15.40646	22	13	67.F	62.F	30.053	-0.845	28	24	37.F	28.F	-2.725	5602.	9.289
MAR	18.42597	9	16	80.F	68.F	35.228	-0.685	31	6	26.F	20.F	-2.942	6232.	9.289
APR	18.72887	14	17	79.F	55.F	32.562	-0.301	2	15	58.F	41.F	-2.646	6012.	9.289
MAY	21.01053	3	14	68.F	67.F	34.047	-0.014	11	14	69.F	51.F	-0.935	6201.	9.289
JUN	22.74300	27	17	84.F	77.F	40.307	0.000					0.000	6027.	9.289
JUL	25.12928	28	17	80.F	77.F	40.282	0.000					0.000	6186.	9.289
AUG	25.16062	17	17	88.F	82.F	44.172	0.000					0.000	6232.	9.289
SEP	22.19930	7	18	86.F	76.F	40.384	0.000					0.000	6012.	9.289
OCT	20.53309	4	17	68.F	67.F	34.908	-0.183	26	18	46.F	35.F	-2.362	6186.	9.289
NOV	17.96486	4	14	67.F	63.F	32.550	-0.544	29	1	34.F	28.F	-2.357	5996.	9.289
DEC	17.07396	2	13	66.F	56.F	28.950	-0.773	27	2	22.F	19.F	-2.655	6201.	9.289
TOTAL	240.828						-4.592						73091.	
MAX						44.172						-3.243		9.289

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AHU_1S WEATHER FILE- PATUXENT, MD

	--ZONE COOLING--		--ZONE HEATING-		--BASEBOARDS--		----PRE-HEAT---	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
FEB	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAR	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
APR	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAY	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
NOV	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
DEC	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
TOTAL	0.000		0.000		0.000		0.000	
MAX		0.000		0.000		0.000		0.000

ENTECH ENGINEERING   EZDOE - ELITE SOFTWARE DEVELOPMENT INC   DOE-2.1D   8/24/1995   12:12:48 SDL RUN 1
READING, PA 19603   FT. McNAIR   GEORGE C. MARSHALL HALL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR   AHU_2   WEATHER FILE- PATUXENT, MD

	- - - COOLING - - -						- - - HEATING - - -						- - - ELEC - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	57.02017	26	17	61.F	52.F	225.642	-312.593	17	22	-1.F	-2.F	-987.938	55002.	118.093
FEB	52.20533	22	13	67.F	62.F	328.956	-226.179	5	7	22.F	19.F	-708.184	49724.	118.227
MAR	78.27241	9	16	80.F	68.F	573.053	-164.351	31	6	26.F	20.F	-642.011	56528.	118.640
APR	94.83755	14	17	79.F	55.F	459.000	-79.173	2	6	36.F	31.F	-449.757	53825.	118.778
MAY	185.17914	31	14	76.F	67.F	514.936	-35.615	26	4	51.F	43.F	-142.442	55173.	118.823
JUN	306.61838	30	16	91.F	77.F	912.564	-21.789	5	7	63.F	63.F	-96.596	54752.	119.319
JUL	400.37494	14	17	92.F	76.F	891.063	-23.051	24	6	66.F	65.F	-89.082	54586.	119.372
AUG	394.88599	18	17	93.F	82.F	1103.807	-20.507	21	1	65.F	62.F	-97.589	56816.	119.466
SEP	273.06778	2	15	86.F	76.F	864.666	-26.631	30	6	49.F	47.F	-131.757	53968.	119.310
OCT	152.42366	12	16	83.F	66.F	555.221	-61.273	27	7	38.F	32.F	-420.769	54405.	118.841
NOV	75.73118	4	11	69.F	64.F	392.439	-136.106	28	7	34.F	28.F	-527.374	53053.	118.724
DEC	56.64940	2	13	66.F	56.F	258.626	-230.587	27	2	22.F	19.F	-698.351	55013.	117.917
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TOTAL	2127.268						-1337.853						652863.	
MAX						1103.807						-987.938		119.466

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AHU_2 WEATHER FILE- PATUXENT, MD

	--ZONE COOLING--		--ZONE HEATING-		--BASEBOARDS--		----PRE-HEAT---	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	-57.83345	-156.491	0.00000	0.000	-162.01743	-653.001
FEB	0.00000	0.000	-49.91695	-154.651	0.00000	0.000	-112.97348	-376.692
MAR	0.00000	0.000	-45.47707	-145.743	0.00000	0.000	-67.59772	-326.095
APR	0.00000	0.000	-41.26482	-139.367	0.00000	0.000	-15.34934	-205.550
MAY	0.00000	0.000	-34.01635	-115.723	0.00000	0.000	-0.49605	-43.989
JUN	0.00000	0.000	-21.63584	-96.596	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	-23.05084	-89.082	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	-20.50713	-97.589	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	-26.29402	-111.422	0.00000	0.000	-0.22670	-43.807
OCT	0.00000	0.000	-40.57429	-124.810	0.00000	0.000	-7.01868	-180.094
NOV	0.00000	0.000	-48.45537	-138.828	0.00000	0.000	-46.84590	-240.227
DEC	0.00000	0.000	-55.33371	-149.375	0.00000	0.000	-117.41666	-370.393
TOTAL	0.000		-464.361		0.000		-529.941	
MAX		0.000		-156.491		0.000		-653.001

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AHU_3 WEATHER FILE- PATUXENT, MD

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	31.20202	5	14	55.F	40.F	127.459	-149.809	17	22	-1.F	-2.F	-470.281	29245.	75.456
FEB	28.11128	22	13	67.F	62.F	157.508	-104.167	5	7	22.F	19.F	-353.718	26777.	75.416
MAR	46.50309	9	16	80.F	68.F	374.604	-72.937	18	7	30.F	24.F	-295.150	31088.	76.006
APR	55.72951	14	17	79.F	55.F	289.174	-34.580	6	7	38.F	33.F	-199.797	28975.	75.934
MAY	108.87882	3	14	68.F	67.F	330.188	-11.241	26	4	51.F	43.F	-67.980	31558.	75.991
JUN	165.47552	8	16	83.F	72.F	440.203	-13.408	29	7	65.F	61.F	-59.599	27604.	76.215
JUL	204.16315	14	17	92.F	76.F	422.404	-23.331	21	7	76.F	69.F	-59.447	23479.	45.851
AUG	201.67232	18	17	93.F	82.F	525.884	-20.824	8	7	68.F	67.F	-61.053	24740.	45.958
SEP	149.23027	16	17	82.F	72.F	462.219	-11.462	30	6	49.F	47.F	-65.153	28702.	76.227
OCT	90.38429	4	17	68.F	67.F	352.437	-21.164	27	7	38.F	32.F	-177.827	31002.	76.134
NOV	47.27268	4	14	67.F	63.F	273.902	-56.185	28	7	34.F	28.F	-249.591	30574.	75.850
DEC	31.51588	2	13	66.F	56.F	180.574	-105.825	27	2	22.F	19.F	-348.445	29967.	75.305
TOTAL	1160.141						-624.932						343710.	
MAX						525.884						-470.281		76.227

ENTECH ENGINEERING   EZDOE - ELITE SOFTWARE DEVELOPMENT INC   DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1

READING, PA 19603   FT. McNAIR   GEORGE C. MARSHALL HALL

REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AHU_3   WEATHER FILE- PATUXENT, MD

	- - Z O N E C O O L I N G - -		- - Z O N E H E A T I N G -		- - B A S E B O A R D S - -		- - - - P R E - H E A T - - -	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	-24.84757	-63.440	0.00000	0.000	-80.61427	-328.789
FEB	0.00000	0.000	-20.38444	-58.783	0.00000	0.000	-54.39658	-200.755
MAR	0.00000	0.000	-17.68887	-55.445	0.00000	0.000	-31.71039	-168.171
APR	0.00000	0.000	-16.59147	-52.459	0.00000	0.000	-7.77633	-109.892
MAY	0.00000	0.000	-10.71532	-41.390	0.00000	0.000	-0.16817	-17.181
JUN	0.00000	0.000	-13.35449	-59.599	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	-23.33108	-59.447	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	-20.82369	-61.053	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	-11.28948	-43.701	0.00000	0.000	-0.14000	-26.722
OCT	0.00000	0.000	-12.65115	-47.074	0.00000	0.000	-2.56728	-93.166
NOV	0.00000	0.000	-16.10376	-53.561	0.00000	0.000	-21.49885	-126.124
DEC	0.00000	0.000	-22.36731	-57.845	0.00000	0.000	-56.56693	-199.270
TOTAL	0.000		-210.148		0.000		-255.439	
MAX		0.000		-63.440		0.000		-328.789

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AHU_4 WEATHER FILE- PATUXENT, MD

	- - - - - - - - C O O L I N G - - - - - - - -						- - - - - - - - H E A T I N G - - - - - - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	16.86012	9	14	65.F	58.F	64.483	-116.224	17	22	-1.F	-2.F	-331.628	9116.	23.361
FEB	15.32233	22	13	67.F	62.F	83.742	-85.675	5	7	22.F	19.F	-245.639	8385.	23.378
MAR	22.65845	9	16	80.F	68.F	215.974	-64.960	31	6	26.F	20.F	-214.956	9743.	23.673
APR	24.63401	14	17	79.F	55.F	160.534	-34.833	2	6	36.F	31.F	-155.858	9035.	23.586
MAY	53.53349	31	14	76.F	67.F	187.775	-17.324	26	4	51.F	43.F	-68.443	10071.	23.621
JUN	91.16917	8	16	83.F	72.F	270.361	-20.551	29	4	64.F	60.F	-63.050	8335.	23.695
JUL	115.58707	10	14	88.F	78.F	223.091	-30.230	1	5	67.F	65.F	-61.059	6627.	10.169
AUG	111.86188	18	17	93.F	82.F	257.719	-28.369	11	7	70.F	68.F	-59.286	6940.	10.169
SEP	80.79334	16	16	84.F	72.F	273.990	-18.488	30	4	49.F	47.F	-69.397	8892.	23.698
OCT	43.22084	12	16	83.F	66.F	203.380	-25.061	27	7	38.F	32.F	-136.830	9909.	23.656
NOV	20.90323	4	11	69.F	64.F	130.320	-50.850	28	7	34.F	28.F	-171.353	9809.	23.543
DEC	16.71547	2	13	66.F	56.F	82.068	-87.852	27	2	22.F	19.F	-242.703	9427.	23.420
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TOTAL	613.262						-580.418						106294.	
MAX						273.990						-331.628		23.698

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AHU_4 WEATHER FILE- PATUXENT, MD

	- -Z O N E C O O L I N G- -		- -Z O N E H E A T I N G-		- - B A S E B O A R D S - -		- - - -P R E - H E A T - - -	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	-23.28415	-43.035	0.00000	0.000	-67.99226	-242.496
FEB	0.00000	0.000	-20.19651	-42.657	0.00000	0.000	-50.05220	-153.797
MAR	0.00000	0.000	-20.00587	-42.589	0.00000	0.000	-32.64236	-126.909
APR	0.00000	0.000	-20.80660	-42.391	0.00000	0.000	-9.05739	-83.688
MAY	0.00000	0.000	-16.48777	-42.524	0.00000	0.000	-0.75376	-26.269
JUN	0.00000	0.000	-20.53730	-63.050	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	-30.22957	-61.059	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	-28.36950	-59.286	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	-18.28785	-43.526	0.00000	0.000	-0.19628	-26.190
OCT	0.00000	0.000	-17.78688	-41.381	0.00000	0.000	-4.43663	-83.890
NOV	0.00000	0.000	-17.68922	-42.677	0.00000	0.000	-23.75415	-97.890
DEC	0.00000	0.000	-21.64618	-42.608	0.00000	0.000	-51.97903	-141.970
TOTAL	0.000		-255.327		0.000		-240.864	
MAX		0.000		-63.050		0.000		-242.496

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AHU_5 WEATHER FILE- PATUXENT, MD

	- - - - - - - - C O O L I N G - - - - - - - -						- - - - - - - - H E A T I N G - - - - - - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	54.95115	26	15	62.F	51.F	268.669	-232.937	17	22	-1.F	-2.F	-759.551	52796.	114.951
FEB	51.03272	22	13	67.F	62.F	337.250	-156.111	5	7	22.F	19.F	-564.685	47833.	115.819
MAR	91.97379	9	16	80.F	68.F	660.774	-101.116	31	6	26.F	20.F	-450.787	54770.	117.410
APR	123.59849	14	17	79.F	55.F	520.485	-42.986	2	6	36.F	31.F	-296.345	52457.	118.119
MAY	221.99196	3	15	66.F	66.F	569.982	-12.032	10	7	51.F	48.F	-88.567	54258.	118.421
JUN	346.00690	27	17	84.F	77.F	1029.136	0.000					0.000	54247.	118.833
JUL	443.31958	14	17	92.F	76.F	998.159	0.000					0.000	54311.	118.868
AUG	433.31976	17	17	88.F	82.F	1223.123	0.000					0.000	56232.	118.883
SEP	288.54150	7	17	86.F	75.F	966.224	0.000					0.000	52885.	118.874
OCT	176.84048	11	17	81.F	66.F	647.322	-31.142	27	7	38.F	32.F	-283.884	53078.	118.221
NOV	86.94466	4	16	66.F	62.F	457.924	-91.218	28	7	34.F	28.F	-418.574	51212.	117.154
DEC	53.88232	2	13	66.F	56.F	275.892	-170.204	27	2	22.F	19.F	-542.632	52827.	114.438
TOTAL	2372.403						-837.747						636905.	
MAX						1223.123						-759.551		118.883

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AHU_5 WEATHER FILE- PATUXENT, MD

MONTH	--ZONE COOLING--		--ZONE HEATING-		--BASEBOARDS--		---PRE-HEAT---	
	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	-66.78356	-187.316	0.00000	0.000	-103.22388	-471.914
FEB	0.00000	0.000	-48.88223	-169.268	0.00000	0.000	-64.67354	-280.329
MAR	0.00000	0.000	-34.70913	-126.568	0.00000	0.000	-31.20531	-218.282
APR	0.00000	0.000	-22.31277	-115.707	0.00000	0.000	-4.88006	-130.077
MAY	0.00000	0.000	-11.38229	-88.567	0.00000	0.000	0.00000	0.000
JUN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.00000	0.000	-19.86091	-98.080	0.00000	0.000	-1.94466	-111.275
NOV	0.00000	0.000	-40.33175	-125.990	0.00000	0.000	-23.58060	-174.471
DEC	0.00000	0.000	-63.92500	-159.362	0.00000	0.000	-67.72165	-284.715
TOTAL	0.000		-308.187		0.000		-297.230	
MAX		0.000		-187.316		0.000		-471.914

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AHU_6 WEATHER FILE- PATUXENT, MD

	- - - - - - - - C O O L I N G - - - - - - - -						- - - - - - - - H E A T I N G - - - - - - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	87.96654	9	14	65.F	58.F	325.940	-285.337	17	22	-1.F	-2.F	-883.981	61932.	124.922
FEB	81.35644	22	13	67.F	62.F	393.470	-204.453	5	7	22.F	19.F	-665.712	55974.	125.215
MAR	122.87767	9	16	80.F	68.F	616.925	-152.103	31	6	26.F	20.F	-550.164	63375.	126.169
APR	162.84470	14	17	79.F	55.F	509.081	-96.850	2	6	36.F	31.F	-386.587	60535.	127.571
MAY	259.86777	18	17	74.F	64.F	551.315	-57.338	10	7	51.F	48.F	-204.826	62197.	127.845
JUN	302.05615	30	16	91.F	77.F	723.510	0.000					0.000	61041.	123.910
JUL	389.22711	10	14	88.F	78.F	716.735	0.000					0.000	61224.	123.910
AUG	379.80209	18	17	93.F	82.F	847.406	0.000					0.000	63257.	123.910
SEP	271.56888	2	15	86.F	76.F	688.831	0.000					0.000	60364.	123.910
OCT	226.93045	11	17	81.F	66.F	628.096	-90.731	1	2	59.F	56.F	-939.209	61484.	127.683
NOV	130.63702	4	14	67.F	63.F	461.803	-140.063	28	7	34.F	28.F	-476.956	59800.	126.951
DEC	88.65864	2	13	66.F	56.F	318.738	-215.568	27	2	22.F	19.F	-625.253	61919.	124.719
TOTAL	2503.792						-1242.441						733092.	
MAX						847.406						-939.209		127.845

REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AHU_6 WEATHER FILE- PATUXENT, MD

	--ZONE COOLING--		--ZONE HEATING-		--BASEBOARDS--		----PRE-HEAT---	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	-139.66771	-327.572	0.00000	0.000	-75.24444	-450.116
FEB	0.00000	0.000	-115.54520	-309.203	0.00000	0.000	-41.93457	-218.926
MAR	0.00000	0.000	-101.01324	-274.361	0.00000	0.000	-13.01313	-175.475
APR	0.00000	0.000	-79.51798	-247.070	0.00000	0.000	-0.89403	-73.803
MAY	0.00000	0.000	-56.71691	-204.826	0.00000	0.000	0.00000	0.000
JUN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.00000	0.000	-80.02920	-939.209	0.00000	0.000	-0.70589	-52.704
NOV	0.00000	0.000	-101.68314	-253.613	0.00000	0.000	-8.24487	-103.872
DEC	0.00000	0.000	-132.52319	-293.533	0.00000	0.000	-39.95264	-214.557
TOTAL	0.000		-806.696		0.000		-179.990	
MAX		0.000		-939.209		0.000		-450.116

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AHU_7 WEATHER FILE- PATUXENT, MD

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	9.46105	9	14	65.F	58.F	36.828	-88.422	17	8	11.F	11.F	-302.127	10652.	38.752
FEB	8.91128	22	13	67.F	62.F	84.968	-64.418	10	7	23.F	21.F	-215.847	9655.	39.006
MAR	15.26466	10	10	76.F	68.F	217.747	-48.761	18	11	37.F	29.F	-226.802	10955.	39.070
APR	17.02376	14	14	76.F	54.F	112.302	-21.299	6	11	43.F	36.F	-147.115	10547.	39.070
MAY	43.41229	3	14	68.F	67.F	187.536	-4.853	11	14	69.F	51.F	-60.198	10942.	39.070
JUN	97.19832	27	17	84.F	77.F	388.932	0.000					0.000	10855.	39.070
JU[illegible]	140.03853	28	11	83.F	77.F	401.996	0.000					0.000	11020.	39.070
AUG	136.67172	18	17	93.F	82.F	511.998	0.000					0.000	11257.	39.070
SEP	77.87360	2	15	86.F	76.F	379.870	0.000					0.000	10687.	39.070
OCT	33.08790	4	11	69.F	68.F	193.343	-15.053	27	8	38.F	32.F	-149.340	10784.	39.070
NOV	12.87549	4	11	69.F	64.F	130.521	-39.194	29	7	33.F	27.F	-175.222	10336.	38.913
DEC	9.29115	2	13	66.F	56.F	59.769	-68.847	27	8	27.F	23.F	-215.685	10642.	38.721
TOTAL	601.110						-350.848						128330.	
MAX						511.998						-302.127		39.070

REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AHU_7 WEATHER FILE- PATUXENT, MD

	--ZONE COOLING--		--ZONE HEATING-		--BASEBOARDS--		----PRE-HEAT---	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	-23.66261	-87.201	0.00000	0.000	-43.30492	-185.276
FEB	0.00000	0.000	-16.38379	-82.589	0.00000	0.000	-32.73494	-140.924
MAR	0.00000	0.000	-11.91842	-58.379	0.00000	0.000	-22.79334	-121.765
APR	0.00000	0.000	-7.50141	-56.726	0.00000	0.000	-6.33844	-82.025
MAY	0.00000	0.000	-3.67433	-44.517	0.00000	0.000	-0.51251	-20.620
JUN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.00000	0.000	-7.39216	-39.691	0.00000	0.000	-3.31902	-74.653
NOV	0.00000	0.000	-14.00848	-53.800	0.00000	0.000	-15.26038	-87.969
DEC	0.00000	0.000	-22.28273	-65.879	0.00000	0.000	-33.24319	-129.915
TOTAL	0.000		-106.824		0.000		-157.507	
MAX		0.000		-87.201		0.000		-185.276

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AHU_8 WEATHER FILE- PATUXENT, MD

	- - - - - - - - C O O L I N G - - - - - - - -						- - - - - - - - H E A T I N G - - - - - - - -						- - - E L E C - - -	
						MAXIMUM						MAXIMUM	ELEC-	MAXIMUM
	COOLING	TIME		DRY-	WET-	COOLING	HEATING	TIME		DRY-	WET-	HEATING	TRICAL	ELEC
	ENERGY	OF MAX		BULB	BULB	LOAD	ENERGY	OF MAX		BULB	BULB	LOAD	ENERGY	LOAD
MONTH	(MBTU)	DY	HR	TEMP	TEMP	(KBTU/HR)	(MBTU)	DY	HR	TEMP	TEMP	(KBTU/HR)	(KWH)	(KW)
JAN	42.46190	26	17	61.F	52.F	195.566	-99.520	17	22	-1.F	-2.F	-362.141	38519.	83.591
FEB	40.05766	22	13	67.F	62.F	228.963	-64.004	5	7	22.F	19.F	-270.660	34867.	84.043
MAR	68.68776	9	16	80.F	68.F	384.167	-40.140	31	6	26.F	20.F	-205.917	39796.	84.858
APR	92.49297	14	17	79.F	55.F	329.051	-18.845	2	6	36.F	31.F	-128.439	38035.	85.131
MAY	145.69658	18	17	74.F	64.F	347.309	-4.952	15	6	62.F	60.F	-57.447	39184.	85.512
JUN	148.95151	30	16	91.F	77.F	346.686	0.000					0.000	37961.	84.158
JUL	185.66164	8	14	86.F	77.F	338.033	0.000					0.000	37780.	81.302
AUG	181.21083	18	17	93.F	82.F	405.385	0.000					0.000	39270.	81.302
SEP	129.68196	2	15	86.F	76.F	329.140	0.000					0.000	37378.	81.302
OCT	121.12804	11	17	81.F	66.F	375.497	-19.038	1	2	59.F	56.F	-288.204	38412.	85.112
NOV	69.26851	4	16	66.F	62.F	288.481	-38.901	28	7	34.F	28.F	-188.762	37283.	84.827
DEC	42.77118	2	13	66.F	56.F	185.855	-67.113	27	2	22.F	19.F	-260.034	38514.	83.290
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TOTAL	1268.070						-352.512						457023.	
MAX						405.385						-362.141		85.512

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AHU_8 WEATHER FILE- PATUXENT, MD

	--ZONE COOLING--		--ZONE HEATING-		--BASEBOARDS--		----PRE-HEAT---	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	-34.16229	-115.785	0.00000	0.000	-32.84470	-214.445
FEB	0.00000	0.000	-26.31636	-108.731	0.00000	0.000	-16.13273	-104.248
MAR	0.00000	0.000	-18.10717	-90.535	0.00000	0.000	-4.50254	-83.280
APR	0.00000	0.000	-10.97584	-76.359	0.00000	0.000	-0.29222	-34.720
MAY	0.00000	0.000	-4.67225	-57.447	0.00000	0.000	0.00000	0.000
JUN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.00000	0.000	-14.28654	-288.204	0.00000	0.000	-0.21911	-24.765
NOV	0.00000	0.000	-21.76452	-84.218	0.00000	0.000	-3.38121	-49.210
DEC	0.00000	0.000	-31.37870	-103.374	0.00000	0.000	-15.96694	-102.310
TOTAL	0.000		-161.663		0.000		-73.339	
MAX		0.000		-288.204		0.000		-214.445

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AHU_9 WEATHER FILE- PATUXENT, MD

	- - - COOLING - - -						- - - HEATING - - -						- - - ELEC - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	5.18239	9	14	65.F	58.F	25.313	-19.645	17	21	0.F	-1.F	-67.444	3057.	5.816
FEB	4.98176	22	13	67.F	62.F	33.904	-13.986	5	7	22.F	19.F	-47.582	2763.	5.816
MAR	9.12045	5	11	75.F	69.F	50.349	-11.542	31	6	26.F	20.F	-37.604	3114.	5.816
APR	12.71584	4	16	77.F	63.F	37.088	-8.430	2	6	36.F	31.F	-24.536	2978.	5.816
MAY	21.01963	2	11	79.F	67.F	46.007	-6.536	11	6	51.F	45.F	-14.928	3057.	5.816
JUN	27.60180	24	20	79.F	78.F	73.555	0.000					0.000	3007.	5.816
JUL	37.26368	28	16	81.F	77.F	71.522	0.000					0.000	3029.	5.816
AUG	36.59254	17	17	88.F	82.F	88.490	0.000					0.000	3114.	5.816
SEP	24.12185	2	15	86.F	76.F	68.340	0.000					0.000	2978.	5.816
OCT	18.24834	4	14	70.F	68.F	47.915	-8.145	1	2	59.F	56.F	-28.359	3029.	5.816
NOV	9.84673	4	11	69.F	64.F	38.851	-10.517	29	7	33.F	27.F	-29.580	2950.	5.816
DEC	5.65530	2	13	66.F	56.F	26.349	-14.801	27	2	22.F	19.F	-45.206	3057.	5.816
TOTAL	212.349						-93.603						36136.	
MAX						88.490						-67.444		5.816

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AHU_9 WEATHER FILE- PATUXENT, MD

	--ZONE COOLING--		--ZONE HEATING-		--BASEBOARDS--		---PRE-HEAT---	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	-11.60230	-24.978	0.00000	0.000	-4.01687	-33.161
FEB	0.00000	0.000	-9.98747	-24.352	0.00000	0.000	-1.67389	-13.807
MAR	0.00000	0.000	-9.47095	-19.546	0.00000	0.000	-0.24647	-10.213
APR	0.00000	0.000	-7.78024	-17.212	0.00000	0.000	-0.00408	-1.689
MAY	0.00000	0.000	-6.53189	-14.928	0.00000	0.000	0.00000	0.000
JUN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.00000	0.000	-7.67197	-28.359	0.00000	0.000	0.00000	0.000
NOV	0.00000	0.000	-9.02895	-18.978	0.00000	0.000	-0.09407	-4.233
DEC	0.00000	0.000	-11.07181	-23.785	0.00000	0.000	-1.54101	-13.516
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TOTAL	0.000		-73.146		0.000		-7.576	
MAX		0.000		-28.359		0.000		-33.161

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR FC_1 WEATHER FILE- PATUXENT, MD

	- - - - - - - - C O O L I N G - - - - - - - -						- - - - - - - - H E A T I N G - - - - - - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	4.55391	6	17	41.F	33.F	9.677	0.000					0.000	1840.	3.417
FEB	4.28772	28	17	61.F	46.F	10.336	0.000					0.000	1662.	3.417
MAR	5.26799	29	17	50.F	37.F	10.939	0.000					0.000	1870.	3.417
APR	5.44446	20	17	67.F	52.F	11.537	0.000					0.000	1791.	3.417
MAY	6.08696	20	17	65.F	61.F	12.009	0.000					0.000	1840.	3.417
JUN	6.50248	28	17	76.F	63.F	12.656	0.000					0.000	1806.	3.417
JUL	6.74892	26	17	86.F	74.F	12.700	0.000					0.000	1825.	3.417
AUG	6.80407	31	17	87.F	77.F	12.676	0.000					0.000	1870.	3.417
SEP	6.21901	1	17	85.F	73.F	12.599	0.000					0.000	1791.	3.417
OCT	5.71362	7	17	71.F	60.F	11.403	0.000					0.000	1825.	3.417
NOV	5.06865	2	17	57.F	54.F	11.781	0.000					0.000	1776.	3.417
DEC	4.74167	29	17	31.F	26.F	9.983	0.000					0.000	1840.	3.417
TOTAL	67.439						0.000						21734.	
MAX						12.700						0.000		3.417

REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR FC_1 WEATHER FILE- PATUXENT, MD

	--ZONE COOLING--		--ZONE HEATING-		--BASEBOARDS--		---PRE-HEAT---	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	4.55391	9.677	0.00000	0.000	0.00000	0.000	0.00000	0.000
FEB	4.28772	10.336	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAR	5.26799	10.939	0.00000	0.000	0.00000	0.000	0.00000	0.000
APR	5.44446	11.537	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAY	6.08696	12.009	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUN	6.50248	12.656	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	6.74892	12.700	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	6.80407	12.676	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	6.21901	12.599	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	5.71362	11.403	0.00000	0.000	0.00000	0.000	0.00000	0.000
NOV	5.06865	11.781	0.00000	0.000	0.00000	0.000	0.00000	0.000
DEC	4.74167	9.983	0.00000	0.000	0.00000	0.000	0.00000	0.000
TOTAL	67.439		0.000		0.000		0.000	
MAX		12.700		0.000		0.000		0.000

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR FC_2 WEATHER FILE- PATUXENT, MD

	- - - - - - - - C O O L I N G - - - - - - - -					- - - - - - - - H E A T I N G - - - - - - - -					- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	1.26055	6 17	41.F	33.F	2.903	0.000				0.000	404.	0.776
FEB	1.18291	28 17	61.F	46.F	3.055	0.000				0.000	365.	0.776
MAR	1.45155	29 17	50.F	37.F	3.221	0.000				0.000	412.	0.776
APR	1.48237	20 17	67.F	52.F	3.365	0.000				0.000	394.	0.776
MAY	1.63895	20 17	65.F	61.F	3.485	0.000				0.000	404.	0.776
JUN	1.74953	29 17	86.F	71.F	3.644	0.000				0.000	397.	0.776
JUL	1.79665	26 17	86.F	74.F	3.655	0.000				0.000	401.	0.776
AUG	1.82975	31 17	87.F	77.F	3.651	0.000				0.000	412.	0.776
SEP	1.67238	1 17	85.F	73.F	3.631	0.000				0.000	394.	0.776
OCT	1.54052	7 17	71.F	60.F	3.336	0.000				0.000	401.	0.776
NOV	1.38153	2 17	57.F	54.F	3.426	0.000				0.000	390.	0.776
DEC	1.30850	29 17	31.F	26.F	2.975	0.000				0.000	404.	0.776
TOTAL	18.295					0.000					4777.	
MAX					3.655					0.000		0.776

REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR FC_2 WEATHER FILE- PATUXENT, MD

MONTH	- -ZONE COOLING- - ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	- -ZONE HEATING- ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	- -BASEBOARDS- - BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	- - -PRE-HEAT- - - PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	1.26055	2.903	0.00000	0.000	0.00000	0.000	0.00000	0.000
FEB	1.18291	3.055	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAR	1.45155	3.221	0.00000	0.000	0.00000	0.000	0.00000	0.000
APR	1.48237	3.365	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAY	1.63895	3.485	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUN	1.74953	3.644	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	1.79665	3.655	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	1.82975	3.651	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	1.67238	3.631	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	1.54052	3.336	0.00000	0.000	0.00000	0.000	0.00000	0.000
NOV	1.38153	3.426	0.00000	0.000	0.00000	0.000	0.00000	0.000
DEC	1.30850	2.975	0.00000	0.000	0.00000	0.000	0.00000	0.000
TOTAL	18.295		0.000		0.000		0.000	
MAX		3.655		0.000		0.000		0.000

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1

READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR FC_3 WEATHER FILE- PATUXENT, MD

	- - - - - - - - C O O L I N G - - - - - - - -						- - - - - - - - H E A T I N G - - - - - - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	1.04221	6	17	41.F	33.F	2.381	0.000					0.000	400.	0.770
FEB	0.98481	28	17	61.F	46.F	2.539	0.000					0.000	361.	0.770
MAR	1.22322	29	17	50.F	37.F	2.695	0.000					0.000	407.	0.770
APR	1.26656	20	17	67.F	52.F	2.843	0.000					0.000	389.	0.770
MAY	1.42018	20	17	65.F	61.F	2.961	0.000					0.000	400.	0.770
JUN	1.52939	29	17	86.F	71.F	3.121	0.000					0.000	393.	0.770
JUL	1.58169	26	17	86.F	74.F	3.132	0.000					0.000	396.	0.770
AUG	1.60162	31	17	87.F	77.F	3.126	0.000					0.000	407.	0.770
SEP	1.45718	1	17	85.F	73.F	3.107	0.000					0.000	389.	0.770
OCT	1.32609	7	17	71.F	60.F	2.811	0.000					0.000	396.	0.770
NOV	1.17120	2	17	57.F	54.F	2.904	0.000					0.000	385.	0.770
DEC	1.08913	29	17	31.F	26.F	2.457	0.000					0.000	400.	0.770
TOTAL	15.693						0.000						4722.	
MAX						3.132						0.000		0.770

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR FC_3 WEATHER FILE- PATUXENT, MD

	- - Z O N E C O O L I N G - -		- - Z O N E H E A T I N G -		- - B A S E B O A R D S - -		- - P R E - H E A T - - -	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	1.04221	2.381	0.00000	0.000	0.00000	0.000	0.00000	0.000
FEB	0.98481	2.539	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAR	1.22322	2.695	0.00000	0.000	0.00000	0.000	0.00000	0.000
APR	1.26656	2.843	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAY	1.42018	2.961	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUN	1.52939	3.121	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	1.58169	3.132	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	1.60162	3.126	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	1.45718	3.107	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	1.32609	2.811	0.00000	0.000	0.00000	0.000	0.00000	0.000
NOV	1.17120	2.904	0.00000	0.000	0.00000	0.000	0.00000	0.000
DEC	1.08913	2.457	0.00000	0.000	0.00000	0.000	0.00000	0.000
TOTAL	15.693		0.000		0.000		0.000	
MAX		3.132		0.000		0.000		0.000

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR FC_4 WEATHER FILE- PATUXENT, MD

	- - - COOLING - - -						- - - HEATING - - -						- - - ELEC - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.96163	6	17	41.F	33.F	2.813	0.000					0.000	415.	0.981
FEB	0.92439	28	17	61.F	46.F	2.983	0.000					0.000	375.	0.981
MAR	1.20384	29	17	50.F	37.F	3.203	0.000					0.000	429.	0.981
APR	1.26182	20	17	67.F	52.F	3.395	0.000					0.000	406.	0.981
MAY	1.43690	20	17	65.F	61.F	3.542	0.000					0.000	415.	0.981
JUN	1.59768	29	17	86.F	71.F	3.743	0.000					0.000	413.	0.981
JUL	1.63573	26	17	86.F	74.F	3.755	0.000					0.000	408.	0.981
AUG	1.67849	31	17	87.F	77.F	3.750	0.000					0.000	429.	0.981
SEP	1.50041	1	17	85.F	73.F	3.726	0.000					0.000	406.	0.981
OCT	1.31295	7	17	71.F	60.F	3.352	0.000					0.000	408.	0.981
NOV	1.13394	2	17	57.F	54.F	3.471	0.000					0.000	399.	0.981
DEC	1.02316	29	17	31.F	26.F	2.911	0.000					0.000	415.	0.981
TOTAL	15.671						0.000						4920.	
MAX						3.755						0.000		0.981

MONTH	--ZONE COOLING-- ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	--ZONE HEATING- ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	--BASEBOARDS-- BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	---PRE-HEAT--- PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.96163	2.813	0.00000	0.000	0.00000	0.000	0.00000	0.000
FEB	0.92439	2.983	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAR	1.20384	3.203	0.00000	0.000	0.00000	0.000	0.00000	0.000
APR	1.26182	3.395	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAY	1.43690	3.542	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUN	1.59768	3.743	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	1.63573	3.755	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	1.67849	3.750	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	1.50041	3.726	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	1.31295	3.352	0.00000	0.000	0.00000	0.000	0.00000	0.000
NOV	1.13394	3.471	0.00000	0.000	0.00000	0.000	0.00000	0.000
DEC	1.02316	2.911	0.00000	0.000	0.00000	0.000	0.00000	0.000
TOTAL	15.671		0.000		0.000		0.000	
MAX		3.755		0.000		0.000		0.000

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR FC_5 WEATHER FILE- PATUXENT, MD

	- - - COOLING - - -						- - - HEATING - - -						- - - ELEC - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00552	31	24	26.F	21.F	0.011	0.000					0.000	188.	0.494
FEB	0.00857	27	14	41.F	34.F	0.015	-0.001	28	11	52.F	41.F	-0.012	170.	0.494
MAR	0.01055	27	24	43.F	35.F	0.017	-0.005	31	9	34.F	26.F	-0.014	197.	0.494
APR	0.01021	28	14	55.F	44.F	0.015	-0.010	28	14	55.F	44.F	-0.015	185.	0.494
MAY	0.01110	27	9	54.F	50.F	0.015	-0.011	27	13	64.F	55.F	-0.015	188.	0.494
JUN	0.03445	1	21	65.F	58.F	0.049	0.000	1	17	70.F	60.F	-0.015	190.	0.494
JUL	0.03723	31	1	75.F	69.F	0.051	0.000					0.000	184.	0.494
AUG	0.03941	31	1	77.F	74.F	0.055	0.000					0.000	197.	0.494
SEP	0.04067	30	1	59.F	56.F	0.059	0.000					0.000	185.	0.494
OCT	0.04474	29	1	50.F	42.F	0.062	0.000					0.000	184.	0.494
NOV	0.04610	30	22	38.F	32.F	0.066	0.000					0.000	181.	0.494
DEC	0.05049	31	9	30.F	26.F	0.070	0.000					0.000	188.	0.494
TOTAL	0.339						-0.028						2239.	
MAX						0.070						-0.015		0.494

REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR FC_5 WEATHER FILE- PATUXENT, MD

	--ZONE COOLING--		--ZONE HEATING-		--BASEBOARDS--		--PRE-HEAT---	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00552	0.011	0.00000	0.000	0.00000	0.000	0.00000	0.000
FEB	0.00857	0.015	-0.00075	-0.012	0.00000	0.000	0.00000	0.000
MAR	0.01055	0.017	-0.00527	-0.014	0.00000	0.000	0.00000	0.000
APR	0.01021	0.015	-0.01022	-0.015	0.00000	0.000	0.00000	0.000
MAY	0.01110	0.015	-0.01117	-0.015	0.00000	0.000	0.00000	0.000
JUN	0.03445	0.049	-0.00029	-0.015	0.00000	0.000	0.00000	0.000
JUL	0.03723	0.051	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.03941	0.055	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.04067	0.059	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.04474	0.062	0.00000	0.000	0.00000	0.000	0.00000	0.000
NOV	0.04610	0.066	0.00000	0.000	0.00000	0.000	0.00000	0.000
DEC	0.05049	0.070	0.00000	0.000	0.00000	0.000	0.00000	0.000
TOTAL	0.339		-0.028		0.000		0.000	
MAX		0.070		-0.015		0.000		0.000

ENTECH ENGINEERING   EZDOE - ELITE SOFTWARE DEVELOPMENT INC   DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603   FT. McNAIR   GEORGE C. MARSHALL HALL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AC_1   WEATHER FILE- PATUXENT, MD

MONTH	- - - C O O L I N G - - - COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	- - - H E A T I N G - - - HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	- - - E L E C - - - ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	4.07609	27	17	42.F	32.F	7.854	0.000					0.000	1492.	2.777
FEB	3.70780	23	17	50.F	39.F	7.841	0.000					0.000	1348.	2.777
MAR	4.26558	9	17	78.F	66.F	8.282	0.000					0.000	1517.	2.777
APR	4.10284	20	17	67.F	52.F	7.991	0.000					0.000	1453.	2.777
MAY	4.28783	20	17	65.F	61.F	8.373	0.000					0.000	1492.	2.777
JUN	4.34373	30	17	92.F	72.F	8.443	0.000					0.000	1465.	2.777
JUL	4.39873	1	17	81.F	74.F	8.438	0.000					0.000	1480.	2.777
AUG	4.53360	31	17	87.F	77.F	8.447	0.000					0.000	1517.	2.777
SEP	4.23857	1	17	85.F	73.F	8.463	0.000					0.000	1453.	2.777
OCT	4.19810	6	17	70.F	64.F	8.337	0.000					0.000	1480.	2.777
NOV	4.00473	3	17	62.F	59.F	8.316	0.000					0.000	1440.	2.777
DEC	4.11171	2	17	51.F	49.F	7.851	0.000					0.000	1492.	2.777
TOTAL	50.269						0.000						17628.	
MAX						8.463						0.000		2.777

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AC_1 WEATHER FILE- PATUXENT, MD

	--ZONE COOLING--		--ZONE HEATING-		--BASEBOARDS--		---PRE-HEAT---	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
FEB	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAR	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
APR	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAY	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
NOV	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
DEC	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
	----------	----------	----------	----------	----------	----------	----------	----------
TOTAL	0.000		0.000		0.000		0.000	
MAX		0.000		0.000		0.000		0.000

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1

READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AC_2 WEATHER FILE- PATUXENT, MD

	- - - - COOLING - - - -						- - - - HEATING - - - -						- - - ELEC - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.37696	26	16	61.F	52.F	0.958	0.000					0.000	123.	0.276
FEB	0.34422	2	17	46.F	44.F	0.946	0.000					0.000	110.	0.276
MAR	0.40689	4	17	42.F	42.F	0.949	0.000					0.000	126.	0.287
APR	0.39653	19	17	67.F	57.F	0.969	0.000					0.000	120.	0.282
MAY	0.42429	5	16	65.F	55.F	0.957	0.000					0.000	126.	0.283
JUN	0.43299	17	17	62.F	61.F	0.949	0.000					0.000	130.	0.301
JUL	0.43105	22	17	74.F	71.F	0.945	0.000					0.000	131.	0.301
AUG	0.45223	4	17	74.F	65.F	0.944	0.000					0.000	136.	0.304
SEP	0.42406	8	17	74.F	69.F	0.948	0.000					0.000	127.	0.294
OCT	0.41071	13	17	66.F	54.F	0.977	0.000					0.000	123.	0.290
NOV	0.38308	16	17	53.F	52.F	0.949	0.000					0.000	118.	0.277
DEC	0.38650	1	17	47.F	45.F	0.958	0.000					0.000	122.	0.273
TOTAL	4.870						0.000						1492.	
MAX						0.977						0.000		0.304

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AC_2 WEATHER FILE- PATUXENT, MD

	- - Z O N E C O O L I N G - -		- - Z O N E H E A T I N G -		- - B A S E B O A R D S - -		- - - - P R E - H E A T - - -	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.37696	0.958	0.00000	0.000	0.00000	0.000	0.00000	0.000
FEB	0.34422	0.946	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAR	0.40689	0.949	0.00000	0.000	0.00000	0.000	0.00000	0.000
APR	0.39653	0.969	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAY	0.42429	0.957	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUN	0.43299	0.949	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	0.43105	0.945	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.45223	0.944	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.42406	0.948	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.41071	0.977	0.00000	0.000	0.00000	0.000	0.00000	0.000
NOV	0.38308	0.949	0.00000	0.000	0.00000	0.000	0.00000	0.000
DEC	0.38650	0.958	0.00000	0.000	0.00000	0.000	0.00000	0.000
TOTAL	4.870		0.000		0.000		0.000	
MAX		0.977		0.000		0.000		0.000

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1

READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AC_3 WEATHER FILE- PATUXENT, MD

	- - - - - - - - C O O L I N G - - - - - - - -						- - - - - - - - H E A T I N G - - - - - - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.72412	6	17	41.F	33.F	1.962	0.000					0.000	311.	0.712
FEB	0.68781	28	17	61.F	46.F	2.072	0.000					0.000	280.	0.712
MAR	0.88579	9	17	78.F	66.F	2.231	0.000					0.000	319.	0.712
APR	0.92508	20	17	67.F	52.F	2.341	0.000					0.000	304.	0.712
MAY	1.06669	20	17	65.F	61.F	2.612	0.000					0.000	309.	0.712
JUN	1.18959	29	17	86.F	71.F	2.748	0.000					0.000	307.	0.712
JUL	1.23472	26	17	86.F	74.F	2.755	0.000					0.000	306.	0.712
AUG	1.26249	31	17	87.F	77.F	2.753	0.000					0.000	319.	0.712
SEP	1.11205	1	17	85.F	73.F	2.738	0.000					0.000	303.	0.712
OCT	0.98225	12	17	82.F	65.F	2.466	0.000					0.000	306.	0.712
NOV	0.83978	2	17	57.F	54.F	2.403	0.000					0.000	298.	0.712
DEC	0.76278	29	17	31.F	26.F	2.023	0.000					0.000	311.	0.712
TOTAL	11.673						0.000						3673.	
MAX						2.755						0.000		0.712

REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR AC_3 WEATHER FILE- PATUXENT, MD

	--ZONE COOLING--		--ZONE HEATING-		--BASEBOARDS--		---PRE-HEAT---	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
FEB	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAR	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
APR	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAY	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
NOV	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
DEC	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
TOTAL	0.000		0.000		0.000		0.000	
MAX		0.000		0.000		0.000		0.000

ENTECH ENGINEERING   EZDOE - ELITE SOFTWARE DEVELOPMENT INC   DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603   FT. McNAIR   GEORGE C. MARSHALL HALL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR   MECH_RM   WEATHER FILE- PATUXENT, MD

MONTH	- - - COOLING - - - COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	- - - HEATING - - - HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	- - - ELEC - - - ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-8.951	4	8	31.F	26.F	-15.693	13.	0.022
FEB	0.00000					0.000	-7.203	4	10	31.F	29.F	-13.968	10.	0.020
MAR	0.00000					0.000	-6.138	7	9	44.F	40.F	-10.697	9.	0.015
APR	0.00000					0.000	-4.467	9	10	67.F	58.F	-9.337	6.	0.013
MAY	0.00000					0.000	-2.696	11	10	61.F	49.F	-6.331	4.	0.009
JUN	0.00000					0.000	-0.884	1	9	65.F	58.F	-3.686	1.	0.005
JUL	0.00000					0.000	0.000					0.000	0.	0.000
AUG	0.00000					0.000	-0.100	26	11	77.F	68.F	-1.316	0.	0.002
SEP	0.00000					0.000	-0.834	23	10	68.F	55.F	-3.519	1.	0.005
OCT	0.00000					0.000	-3.219	29	10	58.F	51.F	-6.820	5.	0.010
NOV	0.00000					0.000	-5.070	26	9	46.F	44.F	-9.625	7.	0.014
DEC	0.00000					0.000	-7.715	23	10	42.F	41.F	-12.368	11.	0.018
TOTAL	0.000						-47.277						67.	
MAX						0.000						-15.693		0.022

ENTECH ENGINEERING EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 8/24/1995 12:12:48 SDL RUN 1
READING, PA 19603 FT. McNAIR GEORGE C. MARSHALL HALL
REPORT- SS-B SYSTEM MONTHLY LOADS SUMMARY FOR MECH_RM WEATHER FILE- PATUXENT, MD

	- - Z O N E C O O L I N G - -		- - Z O N E H E A T I N G -		- - B A S E B O A R D S - -		- - - P R E - H E A T - - -	
MONTH	ZONE COIL COOLING ENERGY (MBTU)	MAXIMUM ZONE COIL COOLING LOAD (KBTU/HR)	ZONE COIL HEATING ENERGY (MBTU)	MAXIMUM ZONE COIL HEATING LOAD (KBTU/HR)	BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING LOAD (KBTU/HR)	PRE-HEAT COIL ENERGY (MBTU)	MAXIMUM PRE-HEAT COIL LOAD (KBTU/HR)
JAN	0.00000	0.000	-8.95052	-15.693	0.00000	0.000	0.00000	0.000
FEB	0.00000	0.000	-7.20312	-13.968	0.00000	0.000	0.00000	0.000
MAR	0.00000	0.000	-6.13754	-10.697	0.00000	0.000	0.00000	0.000
APR	0.00000	0.000	-4.46727	-9.337	0.00000	0.000	0.00000	0.000
MAY	0.00000	0.000	-2.69623	-6.331	0.00000	0.000	0.00000	0.000
JUN	0.00000	0.000	-0.88393	-3.686	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	-0.10018	-1.316	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	-0.83433	-3.519	0.00000	0.000	0.00000	0.000
OCT	0.00000	0.000	-3.21947	-6.820	0.00000	0.000	0.00000	0.000
NOV	0.00000	0.000	-5.06959	-9.625	0.00000	0.000	0.00000	0.000
DEC	0.00000	0.000	-7.71480	-12.368	0.00000	0.000	0.00000	0.000
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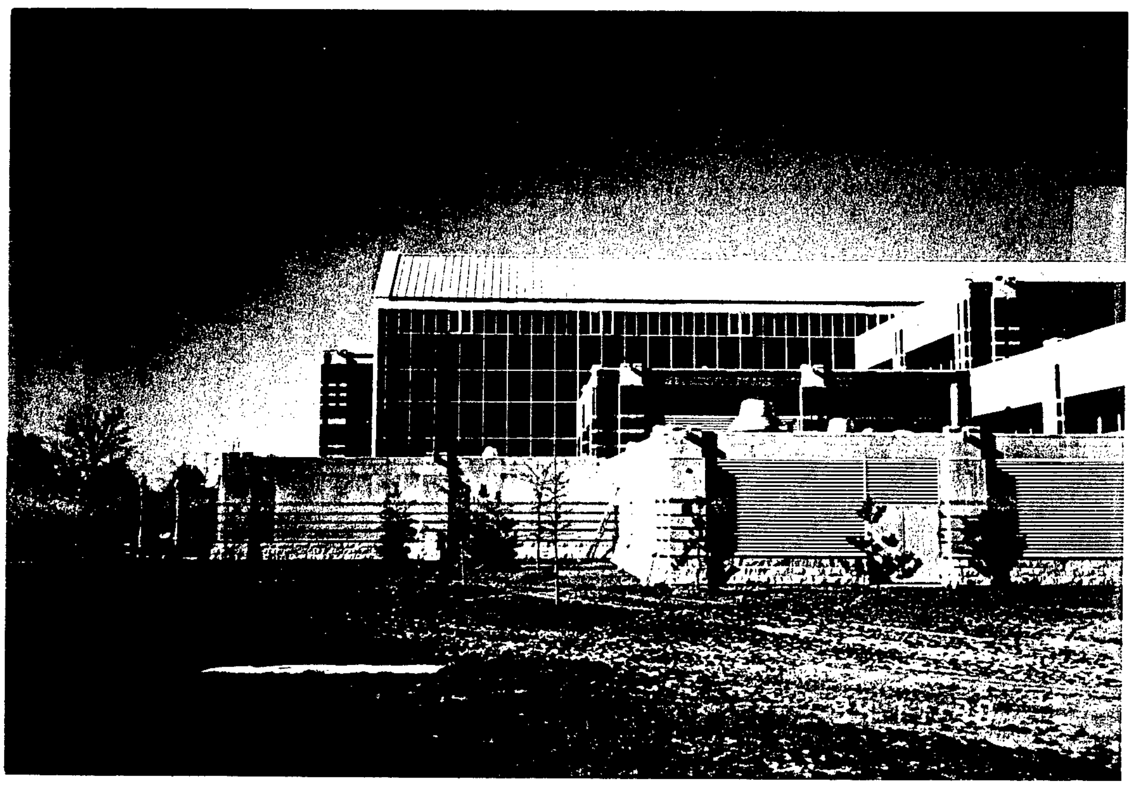
TOTAL	0.000		-47.277		0.000		0.000	
MAX		0.000		-15.693		0.000		0.000

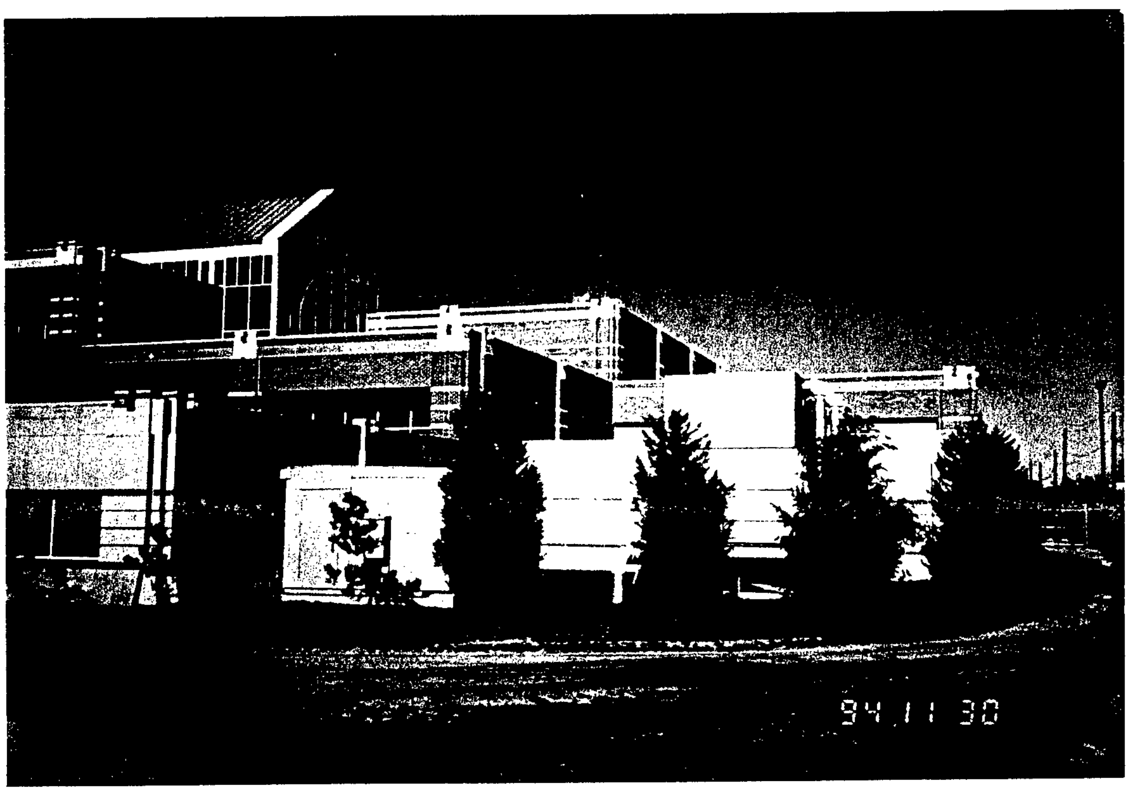
HOURLY DATA FILE 1FROM PROG 2

ATTACHMENT 10.8
BUILDING PHOTOGRAPHS


94 11 30




94 11 30


94 11 30

ATTACHMENT 10.9
SCOPE OF ARCHITECT-ENGINEER SERVICES

CENAB-EN-MS

4 AUGUST 1994

APPENDIX "A"

CONTRACT NO. DACA01-94-D-0037

DELIVERY ORDER NO. 0002

SCOPE OF ARCHITECT-ENGINEER SERVICES

FOR

SINGLE BUILDING STUDY

ACADEMIC OPERATIONS BUILDING, MARSHALL HALL

NATIONAL DEFENSE UNIVERSITY

BUILDING 62, FORT MCNAIR

WASHINGTON, DC

Performed as part of the

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

TABLE OF CONTENTS

ANNEXES

1. <u>BRIEF DESCRIPTION OF WORK:</u> The Architect-Engineer (A-E) shall:

1.1. Review design & construction contract files, operations & maintenance records, utility bills, and all other records and files available, and pertinent, to the identification and evaluation of energy conservation opportunities (ECOs) to reduce the energy consumption of the building covered by this study.

1.2. Perform a limited site survey of the building covered by this study to collect physical data required to identify and evaluate specific ECOs and to get familiar with the operation of the building.

1.3. Evaluate identified ECOs to determine their energy savings potential and economic feasibility.

1.4. Provide project documentation for identified ECOs as detailed herein.

1.5. Prepare a comprehensive report to document all work performed, the results and all recommendations.

2. <u>GENERAL:</u>

2.1. This study is limited to the evaluation of Acedemic Operations Building, Marshall Hall, National Defense University, Building 62, Fort McNair, Washington, DC as delineated in ANNEX A, DETAILED SCOPE OF WORK.

2.2. The information and analysis outlined herein are considered to be minimum requirements for adequate performance of this study.

2.3. For this study all methods of energy conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures as well as the physical facilities. All energy conservation opportunities which produce energy or dollar savings shall be documented in this report. Any energy conservation opportunity considered infeasible shall also be documented in the report with reasons for elimination.

2.4. The study shall consider the use of all energy sources applicable to Building 62.

2.5. The "Energy Conservation Investment Program (ECIP) Guidance", described in letter from CEHSC-FU, dated 4 Nov 1992 and the latest revision from CEHSC-FU establishes criteria for ECIP projects and shall be used for performing the economic analyses of all ECOs and projects. The program, Life Cycle Cost In Design (LCCID), has been developed for performing life cycle cost analysis (LCCA) calculations in accordance with ECIP guidelines and is referenced in the ECIP Guidance. If any program other than LCCID is proposed for LCCA, it must use the mode of calculation specified in the ECIP Guidance. The output must be in the format of the ECIP LCCA summary sheet, and it must be submitted for approval to the Contracting Officer.

2.6. Computer modeling will be used to determine the energy savings of ECOs which would replace or significantly change an existing heating, ventilating, and air-conditioning (HVAC) system. Modeling will be done using a professionally recognized and proven computer program or programs that integrate architectural features with air-conditioning, heating, lighting and other energy-producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads of the building under study. The program will use established weather data files and may perform calculations on a true hour-by-hour basis or may condense the weather files and the number of calculations into several "typical" days per month. ANNEX A, DETAILED SCOPE OF WORK, will list programs that are acceptable to the Contracting Officer. If the A-E desires to use a different program, it must be submitted for approval with a sample run, an explanation of all input and output data, and a summary of program methodology and energy evaluation capabilities.

2.7. Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to the Military District of Washington (MDW). This may involve combining similar ECOs into larger packages which will qualify for ECIP, MCA, or PCIP funding, and determining in coordination with MDW the appropriate packaging and implementation approach for all feasible ECOs.

2.7.1. Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Savings to Investment Ratio (SIR).

2.7.2. All feasible non-ECIP projects shall be ranked in order of highest to lowest SIR.

2.7.3. At some installations Energy Conservation and Management (ECAM) funding will be used instead of ECIP funding. The criteria for each program is the same. MDW will indicate which program is used at this installation. This Scope of Work mentions only ECIP, however, ECAM is also meant.

3. PROJECT MANAGEMENT:

3.1. Project Managers. The A-E shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The A-E designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for coordination of work required under this contract. The Contracting Officer will designate an individual in Baltimore District to serve as the Government point of contact and liaison for all work required under this contract. This individual will be known as the Government representative.

3.2. Installation Assistance. The Commanding Officer or authorized representative at MDW will designate an individual to assist the A-E in obtaining information and establishing contacts necessary to accomplish the work required under this contract. This individual will be known as the installation representative.

3.3. Public Disclosures. The A-E shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4. Meetings. Meetings will be scheduled whenever requested by the A-E project manager, the Government representative, or the installation representative for the resolution of questions or problems encountered in the performance of the work. The A-E project manager and the Government representative shall be required to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences.

3.5. Site Visits, Inspections, and Investigations. The A-E shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6. Records.

3.6.1. The A-E shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., relative to this contract in which the A-E and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The A-E shall forward to the Government representative within ten calendar days, a reproducible copy of the records.

3.6.2. The A-E shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The A-E shall forward to the Government representative within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.7. Interviews. The A-E and the Government representative shall conduct entry and exit interviews with MDW before starting work at Fort McNair and after completion of the field work. The Government representative shall schedule the interviews at least one week in advance.

3.7.1. Entry. The entry interview shall describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

a. Schedules.

b. Names of energy analysts who will be conducting the site survey.

c. Proposed working hours.

d. Support requirements from MDW.

3.7.2. Exit. The exit interview shall briefly describe the items surveyed and probable areas of energy conservation. The interview shall also solicit input and advice from MDW.

4. <u>SERVICES AND MATERIALS:</u> All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, supervision and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5. <u>PROJECT DOCUMENTATION:</u> All energy conservation opportunities which the A-E has considered shall be included in one of the following categories and presented as such in the report:

5.1. <u>ECIP Projects.</u> To qualify as an ECIP project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than $300,000, a SIR greater than one and a simple payback period of less than ten years. For ECAM projects, the $300,000 limitation may not apply; in such cases, the A-E shall check with Fort McNair for guidance. The overall project and each discrete part of the project shall have an SIR greater than one. All projects meeting the above criteria shall be arranged as specified in paragraph 2.7.1 and shall be provided with programming documentation. Programming documentation shall consist of a DD Form 1391, LCCA summary sheet(s) (with necessary backup data to verify the numbers presented), and a Project Development Brochure (PDB). A LCCA summary sheet shall be developed for each ECO and for the overall project when more than one ECO are combined. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. For projects and ECOs reevaluated from previous studies, the backup data shall consist of copies of the original calculations and analysis, with new pages revising the original calculations and analysis. In addition, the backup data shall include as much of the following as is available: the increment of work under which the project or ECO was developed in the previous study, title(s) of the project(s), the energy to cost (E/C) ratio, the benefit to cost (B/C) ratio, the current working estimate (CWE), and the payback period. The purpose of this information is to provide a means to prevent duplication of projects in any future reports.

5.2. <u>Non-ECIP Projects.</u> Projects which do not meet ECIP criteria with regard to cost estimate or payback period, but which have an SIR greater than one shall be documented. Projects or ECOs in this category shall be arranged as specified in paragraph 2.7.2 and shall be provided with the following documentation: LCCA summary sheet completely filled out, a description of the work to be accomplished, backup data for the LCCA, i.e., energy savings calculations and cost estimate(s), and the simple payback period. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government representative, for one of the following categories:

a. Quick Return on Investment Program (QRIP). This program is for projects which have a total cost greater than $3,000 but less than $100,000 and a simple payback period of two years or less.

b. Productivity Enhancing Capital Investment Program (PECIP). This program is for projects which have a total cost of greater than $3,000 but lees than $100,000 and a simple payback period of four years or less.

c. OSD Productivity Investment Funding (OSD PIF). This program is for projects which have a total cost of more than $100,000 and a simple payback period of four years or less.

The above programs and the required documentation forms are all described in detail in AR 5-4, Change No. 1.

d. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than $300,000 and a simple payback period of four to twenty-five years. Documentation shall consist of DD Form 1391 and a Project Development Brochure.

e. Low Cost/No Cost Projects. These are projects which Fort McNair can perform using its resources. Documentation shall be as required by Fort McNair.

5.3 Nonfeasible ECOs. All ECOs which the A-E has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6. DETAILED SCOPE OF WORK: The Detailed Scope of Work is contained in ANNEX A.

7. WORK TO BE ACCOMPLISHED:

7.1. Review Records and Files. Review the records and files which apply to the specific building covered by this study. This review should acquaint the A-E with how the building was designed, constructed, operated, and maintained. Much of the information the A-E will need to develop the ECOs in this study will be contained in these records and files.

7.2. Perform a Limited Site Survey. The A-E shall obtain other necessary data to evaluate the ECOs by conducting a site survey. The A-E shall document his site survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report. All test and/or measurement equipment shall be properly calibrated prior to its use.

7.3. Evaluate Identified ECOs. The A-E shall analyze identified ECOs These ECOs shall be analyzed in detail to determine their feasibility. SIRs shall be determined using current ECIP guidance. The A-E shall provide all data and calculations needed to support the recommended ECO. All assumptions and engineering equations shall be clearly stated. Calculations shall be prepared showing how all numbers in the ECO were figured. Calculations shall be an orderly step-by-step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be included. A LCCA summary sheet shall be prepared for each ECO and included as part of the supporting data.

7.4. Combine ECOs Into Recommended Projects. During the Interim Review Conference, as outlined in paragraph [7.5.1], the A-E will be advised of MDW's preferred packaging of recommended ECOs into projects for implementation. Some projects may be a combination of several ECOs, and others may contain only one. These projects will be evaluated and arranged as outlined in paragraphs 5.1, 5.2, and 5.3. Energy savings calculations shall take into account the synergistic effects of multiple ECOs within a project and the effects of one project upon another. The results of this effort will be reported in the Final Submittal per par [7.5.2].

7.5. Submittals, Presentations, and Reviews. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and shall be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. Names of the persons primarily responsible for the project shall be included. The A-E shall give a formal presentation of the interim submittal to MDW, command, and other Government personnel. Slides or view graphs showing the results of the study to date shall be used during the presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study.

A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. It is anticipated that the presentation and review conference will require approximately one working day. The presentation and review conference will be at Fort McNair on the date agreeable to MDW, the A-E and the Government representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

7.5.1. Interim Submittal. An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings, SIR, and simple payback period of all the ECOs shall be included. The results of the ECO analyses shall be summarized by lists as follows:

a. All ECOs eliminated from consideration shall be grouped into one listing with reasons for their elimination as discussed in par 5.3.

b. All ECOs which were analyzed shall be grouped into two listings, recommended and non-recommended, each arranged in order of descending SIR. These lists may be subdivided by building or area as appropriate for the study.

The A-E shall submit the Scope of Architect-Engineer Services and any modifications to the Scope of Architect-Engineer Services as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. At the Interim Submittal and Review Conference, the Government representative and A-E shall coordinate with MDW to provide the A-E with direction for packaging or combining ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.

7.5.2. Final Submittal. The A-E shall prepare and submit the final report when all sections of the report are 100% complete and all comments from the interim submittal have been resolved. The A-E shall submit the Scope of Architect-Engineer Services for the study and any modifications to the Scope of Architect-Engineer Services as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The recommended projects, as determined in accordance with paragraph 5, shall be presented in order of priority by SIR. The lists of ECOs specified in paragraph [7.6.1] shall also be included for continuity. The final report and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The final report shall be arranged to include:

a. An Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See ANNEX B for minimum requirements).

b. The narrative report describing the problem to be studied, the approach to be used, and the results of this study.

c. Documentation for the recommended projects (includes LCCA Summary Sheets).

d. Appendices to include as a minimum:

1) Energy cost development and backup data.

2) Detailed calculations.

3) Cost estimates.

4) Computer printouts (where applicable).

5) Scope of Architect-Engineer Services.

ANNEX A

DETAILED SCOPE OF WORK

BACKGROUND:

Academic Operations Building, Marshall Hall, National Defense University, Building 62, Fort McNair is a 243,450 square foot building housing offices, classrooms, computer laboratories, library, cafeteria, printing press plant, and support areas. The building was completed in 1991. During FY 92 it consumed 30,520 MBTUs of energy (natural gas and electricity). This study will determine why this facility consumes so much energy and what improvements could be made to reduce the energy usage. The building HVAC system controls are effected through an integral energy management system, thus, the study should evaluate the operation of this system as well as any equipment, building envelope, or lighting system modifications that could be made to reduce energy consumption.

PRE-NEGOTIATION CONFERENCE:

A pre-negotiation conference was held on 18 July 1994 at Fort McNair to review the general scope for the project and to develop this detailed scope of work. The following specific requirements were identified:

a. Military District of Washington (MDW) had expected Building 62 to be more energy efficient then it had turned out. It is an "energy hog." It has the highest energy use per square foot of any building on Fort McNair.

b. As part of the study, MDW will like to include an assessment of the existing operation and maintenance (O&M) documentation: review what is available, assess its adequacy/ determine what should be on-hand, and recommend means to acquire what is needed.

c. Also as part of the study, MDW will to include an assessment of the building operation: identify problems and recommend corrective measures.

d. There is no set milestone dates driving the study. Adequate time will be allowed to perform a complete and detailed study.

e. Energy utilities serving Building 62 are Potomac Electric Power Company (PEPCO) and Washington Gas.

f. Building 62 is a controlled-access building.

SCHEDULE:

a. Interim Report: Submit within 120 calendar days after date of receipt of order.

b. Prefinal Report: Submit within 90 calendar days after receipt of interim report review comments.

c. Final Report: Submit within 30 calendar days after receipt of prefinal report review comments.

SUBMITTALS:

The reviewers for this project and the distribution of review copies for each submittal are as listed below. Submittal packages are to be sent by express/overnight mail. The transmittal letter to the Government representative will also be used to forward the other review copies by indicating "copies furnished according to the attached list" in the letter and attaching a list of the reviewers listed below. Highlight in yellow marker the recipient of each submittal package.

Reviewers	No. of Copies a.	b.	c.
1. Baltimore District, Corps of Engineers ATTN: CENAB-EN-MS (Mr. Forgue) 10 S. Howard St., Room 10450 Baltimore, MD 21201	4	4	4
2. Military District of Washington Office of the Deputy Chief of Staff for Engineering and Housing ATTN: ANMY-DPW-PWO (MR. MURPHY) Building 308, Fort Myer Arlington, VA 22211-5050	6	6	6
3. Headquarters, US Army Corps of Engineers ATTN: CEMP-ET (Mr. Gentil) 20 Massachusetts Avenue, N.W. Washington, DC 20314-1000	0	0	1*

4. North Atlantic Division, Corps of Engineers ATTN: CENAD-EN-MM (Mr. Wong) 90 Church Street New York, NY 10007-2979	1	1	1
5. Mobile District, Corps of Engineers ATTN: CESAM-EN-CM (Mr. Battaglia) 109 St. Joseph Street Mobile, AL 36628-0001	1	1	1
6. Commander US Army Logistics Evaluation Agency ATTN: LOEA-PL (Mr. Keath) New Cumberland Army Depot New Cumberland, PA 17070-5007	0	0	1*

* Executive Summary only.

SPECIAL CRITERIA AND INSTRUCTIONS:

A computer program titled "Life Cycle Costing in Design (LCCID)" is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. This computer program can be used for performing the economic calculations for ECIP and non-ECIP ECOs. The A-E is encouraged to obtain and use this computer program. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, IL 61801. Their telephone number is (217) 333-3977 or (800) 842-5278.

GOVERNMENT-FURNISHED DATA:

1. Items on loan from Ellerbe Becket (to be returned):
   a. Mechanical Design Analysis (Concept), 01 Jun 84.
   b. Concept Design Analysis, 19 Oct 84.
   c. 65% Design Analysis (Part Two), 23 Sep 85.
   d. BOCA Energy Conservation Analysis, 13 Apr 89.
   e. Final Design Analysis, 01 May 89.

2. Infrared photos.

3. Project files to be made available for review by the A-E with copying facilities being provided by the Government:
   a. Design Contract No. DACA31-84-C-0049, located at Baltimore District Office.
   b. Construction Contract No. DACA31-89-C-0081, located at Capital Area Office, Fort Belvoir.

4. Report on Cost Effective Lighting Retrofit Opportunities at FT. McNair, Building #62, Washington, DC, Survey date: December 21, 1993, by Holzer Energy Management Co. for Potomac Electric Power Company.

5. Operation and maintenance records and files and utility bills.

6. ETL 1110-3-254, Use of Electric Power for Comfort Space Heating.

7. ETL 1110-3-282, Energy Conservation.

8. Architectural and Engineering Instructions.

9. Corps of Engineers Guide Specification (CEGS) 13814, Building Preparation for EMCS.

10. TM 5-785, Engineering Weather Data.

11. TM 5-800-2, General Criteria Preparation of Cost Estimate.

12. TM 5-810-1, Mechanical Design, Heating, Ventilating, and Air-Conditioning.

13. TM 5-815-2, Utility Monitoring and Control Systems (UMCS).

14. AR 415-15, Military Construction Army (MCA) Program Development.

15. AR 415-17, Cost Estimating for Military Programming.

16. AR 420-49, Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems.

17. HNDSP90-244-ED-ME, UMCS Cost Estimating Guides.

18. The latest Tri-Service Cost Index.

19. Example of a correctly completed implementation document.

POINTS OF CONTACT:

Government Representative (Baltimore District):
MR. JOHN M. FORGUE
Phone: (410) 962-4387 FAX: (410) 962-0917

Contracting Officer's Representative (Baltimore District):
MR. RONALD J. MAJ, P.E.
Phone: (410) 962-4363

MDW Installation Representative:
MR. JAMES (BRUCE) MURPHY
Phone: (703) 696-3809 FAX: (703) 696-6422

Capital Area Office POC:
MR. MICHAEL ARMSTRONG
Phone: (703) 806-3767

ANNEX B

EXECUTIVE SUMMARY GUIDLINE

1. Introduction.

2. Building Data (type, size, etc.)

3. Present Energy Consumption of Building and Systems Studied.

   * Total Annual Energy Used.

   * Source Energy Consumption.

     Electricity - KWH, Dollars, BTU
     Fuel Oil - GALS, Dollars, BTU
     Naturâl Gas - THERMS, Dollars, BTU
     Propane - GALS, Dollars, BTU
     Other - QTY, Dollars, BTU

4. Reevaluated Projects Results.

5. Energy Conservation Analysis.

   * ECOs Investigated.

   * ECOs Recommended.

   * ECOs Rejected. (Provide economics or reasons)

   * ECIP Projects Developed. (Provide list)@

   * Non-ECIP Projects Developed. (Provide list)@

   * Operational or Policy Change Recommendations.

     @ Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date.

6. Energy and Cost Savings.

   * Total Potential Energy and Cost Savings.

   * Percentage of Energy Conserved.

   * Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented.

ANNEX C

REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

a. In title block clearly identify projects as "ECIP."

b. Complete description of each item of work to be accomplished including quantity, square footage, etc.

c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).

d. List references, and assumptions, and provide calculations to support dollar and energy savings, and indicate any added costs.

(1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.

(2) Identify weather data source.

(3) Identify infiltration assumptions before and after improvements.

(4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.

e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.

f. Lighting retrofit projects must identify number and type of fixtures, and wattage of each fixture being deleted and installed. New lighting shall be only of the level to meet current criteria. Lamp changes in existing fixtures is not considered an ECIP type project.

g. An ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.

h. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period.

i. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.

j. Any requirements required by ECIP guidance dated 4 Nov 1992 and any revisions thereto. Note that unescalated costs/savings are to be used in the economic analyses.

k. The five digit category number for all ECIP projects except for Family Housing is 80000.

ATTACHMENT 10.10
MEETING MINUTES

Entech Engineering, inc.

Consulting Engineers

Principals:
Daniel J. Castellani, PE
Thomas M. McMahon, PE
William M. McMahon Jr., PE

ENTECH

FORT MCNAIR, MARSHALL HALL MEETING MINUTES NO. 2

Project: Single Building Study, Marshall Hall, Building 62
Entech Project No. 4130.04/843

Contract No.: DACA01-94-D-0037, Delivery Order No. 2

Meeting Date: July 26, 1994
Ft McNair, Building 40

Minutes Issue Date: August 21, 1995

Attendees: Mr. John Forge - Design Manager, CENAB-EN-MS
Mr. Harold Schramm - FIE-Chief Utilities, ANMY-PWO-N
Mr. David Rollins - DPW-FE-USO-SHOP
Mr. Herbert Conley - DPW-FE-USO-SHOP
Mr. Ralph Gibson - Energy Coordinator, DESEH, ADEN-IS

Mr. William M. McMahon Jr., P.E. - Entech Engineering, Inc.
Mr. Brian Pritiskutch - Entech Engineering, Inc.

Distribution: Mr. John Forge - Design Manager, CENAB-EN-MS
NOTE: Please copy all parties you feel need copies.

Mr. William M. McMahon, Jr. - Entech Engineering, Inc.
Mr. Brian Pritiskutch - Entech Engineering, Inc.

Items Discussed:

2.1 Purpose of meeting is to discuss Entech's response to review comments and review ECOs.

2.2 Documented comments provided by the following departments were reviewed by parties present. Copies of comments are attached.

1. CENAB-EN-C
2. CENAB-EN-D
3. CESAM-EN-DM

ENTECH

4 South Fourth Street
P.O. Box 32
Reading
Pennsylvania 19603

Office 610.373.6667

Fax 610.373.7537

The following information corresponds to meeting discussions:

CENAB-EN-C Review Comments

Item No. 3 Entech to provide a statement indicating ECO details, such as cost estimate backups, are located in Section 6.0.

CENAB-EN-D ELEC Review Comments

Item No. 2 Comment is not related to the energy study.

Item No. 3 Entech to provide a statement indicating which ECOs reduce lamp inventory diversity.

Item No. 4 No action required.

Item No. 5 No action required.

Item No. 6 No action required.

Item No. 7 No action required.

Item No. 8 No action required.

Item No. 9 No action required.

Item No. 10 No action required.

Item No. 11 Ft. McNair personnel disagreed with reviewers comment and indicated that ECO #13 should remain recommended.

Item No. 12 No action required.

Item No. 13 Two versions of this ECO exist. It was noted that the non-recommended version had a higher SIR than the recommended one. Entech to re-check and determine which ECO shall be recommended.

Item No. 14 No action required.

CENAB-EN-D MECH Review Comments

Item No. 1 Typo, referenced area to be corrected.

Item No. 2 Typo, referenced area to be corrected.

Item No. 3 Entech to provide statement to the effect that the samples presented in Section #2 are not relative to Ft. McNair.

Item No. 4 Typo, referenced area to be corrected.

Item No. 5 Entech to provide statement indicating why DoE Btu/unit values were used.

Item No. 6 Typo, referenced area to be corrected.

Item No. 7 Entech to provide additional information supporting the $1.00/sf average energy cost.

Item No. 8 Difference in graphs to be corrected.

Item No. 9 Difference in graphs to be corrected.

Item No. 10 Entech to provide additional information and calculations to backup average temperature and humidity.

CESAM-EN-DM Review Comments

Item No. 1 Entech to provide a statement indicating the time periods referenced are provided by the electric utility.

Item No. 2 Typo, referenced area to be corrected.

Item No. 3 Entech to provide a revised statement indicating the top paragraph on page 5-17 is based upon factual data.

Item No. 4 Entech to provide a statement indicating the ventilation quantities are from design documents.

Item No. 5 Entech to reword paragraph 5.10.

Item No. 6 Entech to provide additional information to justify savings claim.

Item No. 7 Entech to provide additional information indicating minimum ventilation rates are maintained.

Item No. 8 Entech to check material cost for kitchen equipment replacements.

Item No. 9 Agreed that 15% reduction in illumination levels will be acceptable.

Item No. 10 Electronic ballasts have been known to cause harmonic distortion problems. These occurrences are few and are dependent on such items as manufacturer and building electrical systems. Entech to provide additional information in the ECO concerning this.

Item No. 11 Entech to re-evaluate payback and SIR with maintenance savings included.

Item No. 12 Consensus, ECOs can not be combined. Entech to provided statements in ECO reflecting this.

Item No, 13 Paragraph referencing PEPCO feeders to be revised. Entech to re-evaluate the project based on all ECOs being implemented.

2.3 The contract reference to three submittals is incorrect. There will be only two submittals during the project. The submittal recently reviewed is considered Pre-Final. Next submission is Final.

2.4 Final submission due August 28, 1995.

2.5 Ft. McNair personnel had not received copies of the study until June. Study was originally sent in March.

2.6 ECO #2, EMCS construction cost of $50,000 is generous. Ft. McNair received contractor estimates of $36,000.

2.7 ECO #11, some areas of Marshall Hall had received lighting reflectors, with delamping and new parabolic lenses.

2.8 ECO #12, bollard lighting cannot be changed because Marshall hall is in a historical district.

2.9 Executive Summary to be revised to include tables listing Recommended, Non-Recommended, ECIP, and Non-ECIP ECOs. This is in accordance with contract documents. All ECOs to be ranked from highest to lowest SIR.

2.10 Entech to investigate whether ECO #4 and #7 should be combined into one because ECO #7 can not be implemented without ECO #4 being implemented.

2.11 Contract Documents and comments to Pre-Final Submittal are to be listed in the Attachments.

2.12 Cost estimate back up is missing for ECO #M.

2.13 Entech to include maintenance savings in applicable ECOs.

2.14 Entech to provide a thorough review of the study for typos and grammar.

2.15 Responses to review comments to be provided in Attachments of final submittal.

2.16 Half of the parking lot lighting is currently not utilized.

2.17 Entech to return all drawings, specifications, and documents received during the project.

The above minutes reflect the writer's interpretation of the meeting events and discussions. Should there be any corrections which are deemed to be required to these minutes, please send a copy of your suggested corrections to the undersigned within five (5) days of receipt. Receiving no corrections, these minutes shall stand as the meeting record.

Respectfully submitted,

William M. McMahon Jr., P.E.
Vice President/Treasurer

ELC:tmg

CENAB-EN-MS 3 JULY 1995

PROJECT: SINGLE BUILDING STUDY, MARSHALL HALL, BUILDING 62

INSTALLATION: FORT MCNAIR, WASHINGTON, DC

TO: ENTECH ENGINEERING, INC.

ATTN: Bill McMahon

TRANSMITTAL OF:

Review comments from Baltimore District, Cost Engineering and Design Branches, and from Mobile District. Will send comments from Fort Myer/McNair when received.

PURPOSE:

XX Per conversation of 3 JULY 1995.

____ Review and comment by

____ Incorporate and furnish responses by ____________________

____ For information and use

____ Action:

REMARKS:

Review meeting is scheduled for 26 JULY 1995 at 10:00 AM in Building 40, Fort McNair.

John M. Forgue
JOHN M. FORGUE
Design Manager
Phone: (410) 962-4387

ENTECH [illegible]
Project, [illegible] ____________
JUL 7 1995
cc: ____________
Route: ____________

COST ENGINEERING BRANCH

CENAB-EN-C (340)

RECEIVED
95 APR 10 PM 4:04

6 Apr 95
Wright/sjw/3993

MEMORANDUM FOR Chief, Military Branch,
ATTN: Mr. Forgue

CENAB-EN-MD

SUBJECT: Single Building Study (EEAP), Marshall Hall, Fort McNair, Washington, D.C.

1. Reference memorandum, CENAB-EN-MS , 14 Feb 95, requesting a review be performed on the concept study for the referenced project sab.

2. The A-E concept study dated March 1995 has been reviewed and the Cost reviewer submits the following comments.

3. There is no backup data for the construction costs shown in the table on page 1-2. Based on the A-E's experience providing similar studies, it is assumed at this time that these cost figures are reasonable. Without the backup data (quantity takeoffs, calculations) it is impossible to verify the reasonableness of the construction costs. With future submissions please provide a detailed breakdown of construction costs to include quantity and calculation backup.

4. Any questions regarding the above should be directed to Mr. Sam Wright, x3993.

Joseph Hemler

JOSEPH HEMLER, P.E.
Chief, Cost Engineering Branch
Engineering Division

File: MCN-180

DESIGN BRANCH

Last Sort Type = None

EEAP Study[One(1) Building]- Ft. McNair- Wash., D. C.

File: R:\mcn\DB5125C4.DBF

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
1	VANDEN	CENAB-EN-D	-	ELE	

CONCEPT STUDY

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
2	VANDEN	CENAB-EN-D	STUDY-	ELE	POWER

Although not part of energy conservation study: a 250-kw diesel generator serving emergency loads seems quite inadequate when compared to 4000-kva of normal power load.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
3	VANDEN	CENAB-EN-D	STUDY-	ELE	LIGHTING

With twenty-nine(29) variations of Type "A" fixture and eighteen(18) variations of Type "D" fixture: this reviewer hopes the number of lamp types required can be drastically reduced. Inventory requirements at NDU should be cut.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
4	VANDEN	CENAB-EN-D	STUDY-	ELE	ECO #2

This office agrees with A/E to utilize the EMCS capabilities more. If "reprogramming" is necessary, then that should receive a top priority. New subroutines can be implemented on the EMCS computer to monitor and control more and new items of equipment.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
5	VANDEN	CENAB-EN-D	STUDY-	ELE	ECO #5

Natural gas as opposed to electricity is a much more efficient means of heating and therefore cooking. This office agrees with proposed transition even though some construction cost will incur, especially when one considers thee cost savings over several years of use.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
6	VANDEN	CENAB-EN-D	STUDY-	ELE	ECO #8

This office agrees with proposal for much of the same reason as expressed in comment "5" above.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
7	VANDEN	CENAB-EN-D	STUDY-	ELE	ECO #9

HPS lamps have the highest efficacy of the HID lamp family and should replace MV bulbs. This office agrees with said proposal.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
8	VANDEN	CENAB-EN-D	STUDY-	ELE	ECO #10

Since use of a more efficient fluorescent lighting fixture results in less electrical power for lighting and less fuel for cooling, this office agrees with said proposal.

EEAP Study[One(1) Building] - Ft. McNair- Wash., D. C.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
9	VANDEN	CENAB-EN-D	STUDY-	ELE	ECO #11

This office agrees with proposal for much of the same reason as expressed in comment "8" above.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
10	VANDEN	CENAB-EN-D	STUDY-	ELE	ECO #12

This office agrees with proposal. Since the life of HPS lamps remains much longer than incandescent bulbs, the need for relamping has been virtually eliminated.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
11	VANDEN	CENAB-EN-D	STUDY-	ELE	ECO #13

Since energy savings is low- $700.00 and payback is long- almost 10 years: this ECO is not worth the effort. Fluorescent light is too dispersive and not easily directed as required by a wall wash application.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
12	VANDEN	CENAB-EN-D	STUDY-	ELE	ECO #14

This office agrees with proposed ECO. Energy should not be wasted in an unoccupied area.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
13	VANDEN	CENAB-EN-D	STUDY-	ELE	ECO- F

Why was this ECO not implemented?

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
14	VANDEN	CENAB-EN-D	GENERAL-	ELE	

This reviewer has previously never seen such an in-depth energy study. A/E is to be commended for developing and using software that is so powerful and detailed. My hat is off to him.

Sngl Bldg Enrgy Stdy(EEAP), Mrshll Hl,McNair,DC CONC STDY

File: R:\mcn\DB5125DK.DBF

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
1	KAMPHAUS	CENAB-EN-D	STUDY-	MEC	

REF: Page 2-13. The example cites a value of 640 SF for the window area in Zone 1 for the Sample Table 2.5.5.1. The window area listed in the table is 360 SF. Please discuss/correct.

2	KAMPHAUS	CENAB-EN-D	STUDY-	MEC	

REF: Page 2-12. The data listed in the tabulation at the bottom of the page gives an outside temperature of 5F and an inside temperature of 65F. The calculation on page 2-13 includes a delta T of (70-0) for these same values. Please check/ review the calculated data.

3	KAMPHAUS	CENAB-EN-D	STUDY-	MEC	

REF: Page 2-12, Table 2.5.5.1. The data listed in the margin at the bottom of the page lists outside temperatures, inside temperatures, relative humidity, wind velocity and other environmental data pertinent to McNair. Appendix "A"- "Scope of Architect-Engineer Services", page A-4, item 10., cites TM 5-785, Engineering Weather Data as a reference to be used in the contracted study. This reference for McNair lists different data for that Table 2.5.5.1. Please review and comment/correct.

4	KAMPHAUS	CENAB-EN-D	STUDY-	MEC	

REF: Page 2-14. The calculation completed here for the energy loss associated with transmission losses through the windows is given as $317. A check of this calculation using the data given in the formula resulted in $314 as the answer. Please review.

5	KAMPHAUS	CENAB-EN-D	STUDY-	MEC	

REF: Page 2-17. Table 2.5.7.1. lists BTU/Unit for various fuels. Appendix "A"-Scope of Architect/Engineer Services, page A-4, item 8 lists Architectural and Engineering Instructions as a reference to be used in the study. This reference on page 11-8, Table 11-2 lists BTU/Unit for various fuels different than those used in the study. Please review and comment.

6	KAMPHAUS	CENAB-EN-D	STUDY-	MEC	

REF: Page 4-1 and 4-2. Energy costs for Electricity, Natural Gas and their total are given, as well as the total floor area for Marshall Hall. These figures are used to calculate Energy Cost per SF (Table 4.1.3). Using the listed data the tabulated figures are in error. Electricity should be $1.42, Natural Gas $).41 and the total $1.83. Please review.

Sngl Bldg Enrgy Stdy(EEAP), Mrshll Hl, McNair, DC CONC STDY

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
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REF: Page 4-2, statement "Entech has found most institutional buildings at approximately $1.00/SF". This is a usage factor and is dependent on the delta T (outside -inside temperature) in calculating the energy used to heat the building. What delta T values were used in the institutional buildings mentioned above and would the values so used as compared to those used for McNair in this study produce non comparable data.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
8	KAMPHAUS	CENAB-EN-D	STUDY-	MEC	

REF: Page 4-8. The symbols used for the identification of the two Electric Usage Data lines (1992-93 and 1993-94) in the graph is not included in the bottom of the graph. Please correct.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
9	KAMPHAUS	CENAB-EN-D	STUDY-	MEC	

REF: Page 4-8, 4-9 and 4-12. Use the same symbol identification for the same years shown graphically in the curves shown on these pages.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
10	KAMPHAUS	CENAB-EN-D	STUDY-	MEC	

REF: Page 5-22. Give references for Average Winter Temperature and Average Winter Relative Humidity given here. The figures appear to be high.

MOBILE DISTRICT

FACSIMILE HEADER SHEET

COMMAND/OFFICE	NAME/OFFICE SYMBOL	OFFICE PHONE	FAX
From: USAED Mobile, AL	Tony Battaglia CESAM-EN-DM	(334) 690-2618	(334) 690-2424
To: USAED Baltimore, MD	John Forgue CENAB-EN-MS	(410) 962-4387	(410) 962-0917

CLASS	PREC	PAGES	DATE-TIME		MO	YR	RELEASER'S SIGNATURE
U	N	2	24	1500	03	95	Anthony M. Battaglia

REMARKS

space below for communications center use only

John:

Our comments on the Limited Energy Study for Marshall Hall at Fort McNair are attached. If you have any questions, call Bob Woodruff at (334) 694-4074 or me at the number listed above.

Thanks,

Tony B.

MOBILE DIST. OFFICE PROJECT REVIEW COMMENTS	DATE: 23 MAR 95	PAGE 1 of 1

TO: Army Corps of Engineers
Baltimore District

FROM: (Section): EN-DM
(Reviewer): Robert S. Woodruff

PROJECT: Marshal Hall Energy Study
LOCATION: FT. McNair

Year:

Line Item No.:

Type of Action: Interim Submittal

Item No.	Drawing No. Or Par. No.	COMMENTS	Review Action
1.	Billing Schedule P. 2-10	The Off-Peak and On-Peak periods of this schedule seem backwards for the heating season. The highest demand time would be during the coldest part of the day.	
2.	Energy Costs P. 4-2	The energy cost per square foot is shown as $ 1.88 in paragraph one, $ 1.89 in the schedule, and $ 1.83 on page 1-3.	
3.	Para 1 P 5-17	The paragraph at the top of this page appears to speculation on the authors part. Is this indeed true or not?	
4.	Para 5.6 P. 5-21	Is the reduction in the ventilation rate in compliance with ASHRAE minimum standards?	
5.	Para 5.10 P. 5-24	This paragraph indicates that about 25% of the gas usage is unaccounted for. It would seem more reasonable to assume that the amount of steam used for the identifiable purposes is greater than estimated rather than assuming such a large amount of energy is lost to cycling.	
6.	ECO- 1 P. 6-4	The first paragraph on this page states an 80% savings is expected. Is this level of savings provable?	
7.	ECO- 3 P. 6-17	In the proposed solution the amount of supply air is cut in half. Is the supply volume great enough to insure that the minimum ventilation rates (ASHRAE) are maintained?	
8.	ECO- 5 P. 6-30	The material cost ($13,000) to replace the kitchen equipment appears to be low. Please recheck.	
9.	ECO-9 P. 6-50	The Discussion paragraph states that the illumination level will be reduced 15%. Is this O.K. with the user?	
10.	ECO-10 P. 6-54	Will the electronic ballasts cause unacceptable harmonic distortion problems?	
11.	ECO-A P. 6-77	The maintenance costs should be considered which will make this ECO feasible.	
12.	ECO-L ECO-I	Can ECO-L and ECO-I be combined into a feasible ECO?	
13.	ECO-M P. 6-128	In the discussion paragraph doesn't PEPCO have to pay for the new feeders?	

ATTENDANCE REGISTER

SUBJECT: SINGLE BUILDING STUDY
MARSHALL HALL

LOCATION: FT. McNAIR, DC

US ARMY CORPS
OF ENGINEERS
BALTIMORE DISTRICT

DATE: 26 JULY 1995

NAME	OFFICE AND TITLE	TELEPHONE NUMBER (INCL. AREA CODE)
John M. Forgue	CENAB-EN-MS DESIGN MANAGER	(410) 962-4387
HAROLD C. SCHRAMM	ARMY-PWO-N FAC ENGR-McNAIR Chief, UTILITIES BR.	(202) 475-1132
David Rollins	DPW FE USO Shop Bldg 62 FT McNAIR EMCS	202) 287-9068
Brian Fritschkutch	EnTech Engineering, Inc. Reading, PA	(610) 373-6667
WILLIAM M. McMAHON JR	ENTECH ENGINEERING INC READING, PA 19603	(610) 373-6667
HERBERT Conley	D.PW FE U.S.O SHOP Bldg 34	202-475-1882
RALPH GIBSON	[illegible] ANEN-[illegible] BLDG 42, McNAIR [illegible] COORDINATOR	(202) 475-[illegible]

ATTACHMENT 10.11
PRE-FINAL REVIEW COMMENTS

COST ENGINEERING BRANCH

CENAB-EN-C (340)

RECEIVED
95 APR 10 PM 4:04

6 Apr 95
Wright/sjw/3993

MEMORANDUM FOR Chief, Military Branch, CENAB-EN-MD
ATTN: Mr. Forgue

SUBJECT: Single Building Study (EEAP), Marshall Hall, Fort McNair, Washington, D.C.

1. Reference memorandum, CENAB-EN-MS , 14 Feb 95, requesting a review be performed on the concept study for the referenced project sab.

2. The A-E concept study dated March 1995 has been reviewed and the Cost reviewer submits the following comments.

3. There is no backup data for the construction costs shown in the table on page 1-2. Based on the A-E's experience providing similar studies, it is assumed at this time that these cost figures are reasonable. Without the backup data (quantity takeoffs, calculations) it is impossible to verify the reasonableness of the construction costs. With future submissions please provide a detailed breakdown of construction costs to include quantity and calculation backup.

4. Any questions regarding the above should be directed to Mr. Sam Wright, x3993.

Joseph Hemler

JOSEPH HEMLER, P.E.
Chief, Cost Engineering Branch
Engineering Division

File: MCN-180

EEAP Study[One(1) Building]- Ft. McNair- Wash., D. C.

File: R:\mcn\DB5125C4.DBF

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
1	VANDEN	CENAB-EN-D	-	ELE	

CONCEPT STUDY

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
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EEAP Study[One(1) Building]- Ft. McNair- Wash., D. C.

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Sngl Bldg Enrgy Stdy(EEAP), Mrshll Hl,McNair,DC CONC STDY

File: R:\mcn\DB5125DK.DBF

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REF: Page 4-8, 4-9 and 4-12. Use the same symbol identification for the same years shown graphically in the curves shown on these pages.

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REF: Page 5-22. Give references for Average Winter Temperature and Average Winter Relative Humidity given here. The figures appear to be high.

MOBILE DISTRICT

FACSIMILE HEADER SHEET

COMMAND/OFFICE	NAME/OFFICE SYMBOL	OFFICE PHONE	FAX
From: USAED Mobile, AL	Tony Battaglia CESAM-EN-DM	(334) 690-2618	(334) 690-2424
To: USAED Baltimore, MD	John Forgue CENAB-EN-MS	(410) 962-4387	(410) 962-0917

CLASS	PREC	PAGES	DATE-TIME		MO	YR	RELEASER'S SIGNATURE
U	N	2	24	1500	03	95	Anthony W. Battaglia

REMARKS

space below for communications center use only

John:

Our comments on the Limited Energy Study for Marshall Hall at Fort McNair are attached. If you have any questions, call Bob Woodruff at (334) 694-4074 or me at the number listed above.

Thanks,

Tony B.

MOBILE DIST. OFFICE PROJECT REVIEW COMMENTS	DATE: 23 MAR 95	PAGE 1 of 1

TO: Army Corps of Engineers Baltimore District	FROM: (Section): EN-DM (Reviewer): Robert S. Woodruff

PROJECT: Marshal Hall Energy Study LOCATION: FT. McNair	Year:	Line Item No.:

Type of Action: Interim Submittal

Item No.	Drawing No. Or Par. No.	COMMENTS	Review Action
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13.	ECO-M P. 6-128	In the discussion paragraph doesn't PEPCO have to pay for the new feeders?	

ATTENDANCE REGISTER

SUBJECT: SINGLE BUILDING STUDY
MARSHALL HALL

LOCATION: FT. McNAIR, DC

US ARMY CORPS
OF ENGINEERS
BALTIMORE DISTRICT

DATE: 26 JULY 1995

NAME	OFFICE AND TITLE	TELEPHONE NUMBER (INCL. AREA CODE)
John M. Forgue	CENAB-EN-MS DESIGN MANAGER	(410) 962-4387
HAROLD C. SCHRAMM	ARMY-PWO-N FAC ENGR-MCNAIR Chief, UTILITIES BR.	(202) 475-1132
David Rollins	DPW FE USO Shop Bldg 62 FT MCNAIR EMCS	202) 287-9068
Brian Fritskutch	Entech Engineering, Inc. Reading, PA	(610) 373-6667
WILLIAM M. MCMAHON JR	ENTECH ENGINEERING INC READING, PA 19603	(610) 373-6667
HERBERT Conley	D.PW FE U.S.O SHOP Bldg 34	202-475-1882
RALPH GIBSON	DCSEH ANPV-[illegible] BLDG 42, McNAIR ENERGY COORDINATOR	(202) 475-[illegible]

ENTECH'S RESPONSE TO PRE-FINAL REVIEW COMMENTS

1.0 Documented comments provided by the following departments were reviewed by parties present. Copies of comments are attached.

1. CENAB-EN-C
2. CENAB-EN-D
3. CESAM-EN-DM

2.0 <u>CENAB-EN-C Review Comments</u>

Item No. 3 Statements have been added to Section 1.0 indicating location of backup data.

3.0 <u>CENAB-EN-D ELEC Review Comments</u>

Item No. 2 Comment is not related to the energy study. No action required.

Item No. 3 where applicable to lighting ECOs statements to this affect have been added.

Item No. 4 No action required.

Item No. 5 No action required.

Item No. 6 No action required.

Item No. 7 No action required.

Item No. 8 No action required.

Item No. 9 No action required.

Item No. 10 No action required.

Item No. 11 Ft. McNair personnel disagreed with reviewers comment and indicated that ECO #13 should remain recommended.

Item No. 12 No action required.

Item No. 13 Two versions of this ECO exist. Lowest construction cost version is recommended. Payback periods of both ECOs are the same.

Item No. 14 No action required.

4.0 CENAB-EN-D MECH Review Comments

Item No. 1 Page 2-13 has been revised to reflect the comment.

Item No. 2 Page 2-12 has been revised to reflect the comment.

Item No. 3 Page 2-12 has been revised to reflect the comment.

Item No. 4 Page 2-14 has been revised to reflect the comment.

Item No. 5 Page 2-17 has been revised to reflect the comment.

Item No. 6 Page 4-1 & 4-2 have been revised to reflect the comment.

Item No. 7 Page 4-2 has been revised to include cost per square foot for similar facilities.

Item No. 8 Symbols used in graphs on pages 4-8, 4-9, and 4-12 have been corrected.

Item No. 9 Symbols used in graphs on pages 4-8, 4-9, and 4-12 have been corrected.

Item No. 10 Backup data has been included.

5.0 CESAM-EN-DM Review Comments

Item No. 1 Billing schedule is Utility provided. Paragraph has been revised to include this statement.

Item No. 2 Page 4-2 has been revised to reflect the comment.

Item No. 3 Page 5-17 has been revised to reflect the comment.

Item No. 4 Page 5-21, Section 5.6 has been revised to reflect the comment.

Item No. 5 Page 5-24, Section 5-10 has been revised to reflect the comment.

Item No. 6 ECO-1 has been revised to include additional backup.

Item No. 7 ECO-3 has been revised to address comment.

Item No. 8 ECO-5 construction cost has been revised.

Item No. 9 Ft. McNair has stated that a 15% reduction in illumination levels will be acceptable. ECO-9 includes this reference.

Item No. 10 ECO-10 has been revised to address this concern.

Item No. 11 Maintenance costs have been included in simple payback and SIR calculation for this ECO.

Item No. 12 Combining Peak Shaving ECO and Curtailment Program have been addressed in the ECOs.

Item No, 13 Statement concerning this have been added to the ECO.

ATTACHMENT 10.12
ADDITIONAL SECTION 5.0 DATA

Average Winter Outdoor Temperature and Relative Humidity

	December		January		February		March	
Temperature Bin	Hours @ Temp	Ratio to Total hrs	Hours @ Temp	Ratio to Total hrs	Hours @ Temp	Ratio to Total hrs	Hours @ Temp	Ratio to Total hrs
77	0	0.0	0	0.0	0	0.0	3	0.3
72	1	0.1	0	0.0	0	0.0	6	0.6
67	4	0.4	2	0.2	3	0.3	11	1.0
62	15	1.2	7	0.6	9	0.8	28	2.3
57	25	1.9	15	1.2	16	1.4	45	3.5
52	55	3.8	30	2.1	29	2.2	84	5.9
47	94	5.9	52	3.3	55	3.9	125	7.9
42	145	8.2	110	6.2	118	7.4	185	10.5
37	142	7.0	153	7.6	158	8.7	136	6.8
32	132	5.7	158	6.8	145	6.9	76	3.3
27	82	3.0	100	3.6	80	3.2	30	1.1
22	40	1.2	67	2.0	34	1.1	12	0.4
17	10	0.2	33	0.8	19	0.5	1	0.0
12	1	0.0	11	0.2	5	0.1	0	0.0
7	0	0.0	3	0.0	0	0.0	0	0.0
2	0	0.0	0	0.0	0	0.0	0	0.0
Totals	746	38.6	741	34.6	671	36.5	742	43.5
	25.7%		25.6%		23.1%		25.6%	

Total hours during winter	2,900
Average Temperature during winter	38.4
Mean coincident wet bulb temperature	33
Relative Humidity at dry and wet bulb	60%

Notes:
1. Bin data from Air Force Engineering Weather Data, Patuxent River NAS, Maryland
2. Ratio to Total hrs = (hrs at temp/total hrs)xtemp
3. Average temperature per month = sum of individual ratios
4 Average Temperature Winter = sum of ratio of monthly temperatures based upon total hour distribution.